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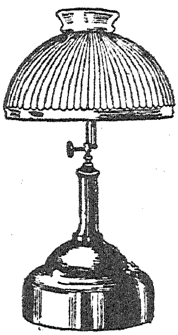

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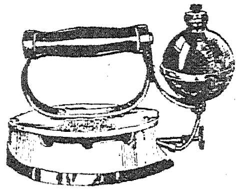

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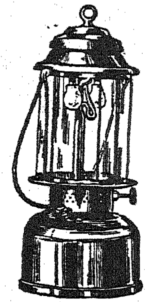

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"THE JOURNAL OF AGRICULTURE"

will be supplied free *on application* to any person in the State who is following Agricultural, Horticultural, or Viticultural pursuits, to Agricultural Societies or Associations, and to any person otherwise interested in Agriculture.

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JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA.

Vol. 2. (Second Series) MARCH, 1925. No. 1.

THE AGRICULTURAL COLLEGE.

The decision of the Government to establish an Agricultural College in this State will receive the ready approbation of every right-thinking person who has the welfare of Western Australia at heart. The avowed objects of the institution are in themselves a guarantee of benefits to be bestowed on the present and future generations. Summarised, they are, under proper guidance, to bring the pastoral, dairying, wheat and fruit-growing industries to the highest degree of efficiency, and this consummation achieved—for failure is inconceivable—our portion of this great Commonwealth must attain that eminence of production to which its vast areas and splendid geographical features entitle it.

During the past two decades agriculture in this State has progressed to an extent not hitherto deemed realisable. For many years development followed on lines of caution rather than enterprise; at least in so far as our wheat belt is concerned. The suitability of our soil was never in question, but with millions upon millions of acres situated in light-rain zones the problem of successful grain production involved risks calculated to curb enthusiasm.

When in 1910-11 the Government of the day placed numbers of settlers on the land East of Northam, now known as the Dowerin-Merredin loop, that forward movement was followed by such a disastrous season that many pessimists were found joining in the strident chorus of "I told you so," and ready to attribute dementia to those who boldly held that the State would yet become a great grain producer. But the seers never lost faith. The agricultural scientist and those whose responsibility it was to give proper guidance towards high efficiency held steadily to their task, and did not waver because of adverse fortune at a critical stage. They counselled perseverance, preserving that cheery optimism that infuses fresh courage in the faltering. They did more. They engaged in an active campaign of experiment, supervision, and instruction. They brought to the embryo farmer a ready-made

experience and saved the individual that discouraging loss of time and money in acquiring by trial and error the knowledge requisite to carry on his avocation. Under these virile methods our cultivable zones reached farther and farther into the sub-arid regions as the potency of moisture conservation by fallow and manurial aids became more widely demonstrated. To-day there are no croakers. The sun rises on a new inheritance, and we know that the limit of our harvests cannot yet be measured in acres.

But there is another aspect of the industry that demands attention, and that is the yield from our land already under cultivation, and it is upon this feature that the staff of the College, so far as it deals with cereals, will have to concentrate attention.

Quick to realise the advantages to be gained by an increase in yield from our already cultivable areas, the Merchants Agricultural Research Committee has been formed with the object of raising £10,000, such sum to be invested in Government bonds, and the interest gained applied to the purpose of agricultural research at "Muresk." The Minister for Agriculture, Mr. Troy, in addressing the gathering which brought this fund into being, struck a true note when he told his hearers that the future mainstay of the State must lie in its agricultural and pastoral industry; and drew attention to the opinion expressed by Professor Richardson, of Victoria, that this State held the largest and safest wheat belt in Australia. Professor Shann, of the Perth University, in speaking to the same audience, emphasised the need for research to increase our productivity of the soil. He pointed out that the average for wheat lands throughout Australia for the five years ending 1913-14 was 11.9 bushels per acre. For the five years ending 1923-24 that average had risen (despite the fact that Western Australia had acted to some extent as a brake) to 12.51 bushels; a rise of .61 bushels for every acre put under crop. This increase was attained, too, during a period which included a season of complete drought in New South Wales and a partial drought in Victoria and South Australia. But what of Western Australia? For the five years ending 1913-14 our average was 10.86 bushels. For the five years ending 1923-24 our average was 10.41 bushels, a falling away of .45 bushels. Had our wheat farmers held their place and done as well as the Commonwealth as a whole, our average would have been 1.06 bushels per acre higher, equal to another 2,000,000 bushels, which at 6s. per bushel, would represent £600,000 for one year. Surely nothing could more clearly demonstrate the need for an Agricultural College where research work can be carried on under conditions favourable to our State.

It is but right to point out, however, that this year our experts estimate we are likely to realise a 12-bushel crop, and that despite a very dry September. This increased average will be largely due to the generally improved methods adopted throughout the State, and had it not been for these, very few of our early crops would have survived that dry period without material and serious loss.

But it is not only to our wheat farmers that the Agricultural College should strongly appeal. Its benefits will not be confined to any particular branch of the industry, nor will one branch be furthered at the expense of another. It is intended that its activities will extend to the general improvement of stock-raising, dairying, fruit-growing, and every phase of the land's production, except the conservation and reafforestation of our timber lands, already the care of another service. The initial aim of the College is said to be "to spread amongst farmers generally the better methods already in use by the best farmers." This is to be accomplished to a great extent by field days and other demonstrations of scientific methods to men on the land.

The College will provide tuition for different classes of students. Those from 16 years of age and upwards will be given a course of two years to complete their apprenticeship to farming, and help them to acquire a critical and scientific attitude towards its problems. These would make up the main body of students, and be admitted without entrance qualification other than their interest in the land. Then it would also comprise those taking a course in agricultural science with a view to fitting themselves for managerial positions in butter, cheese, and bacon factories, departmental inspectors, and allied occupations, as well as those taking the course of B.Sc. in Agriculture at the University, who would make use of the institution for practical and experimental work. In addition to all this the research work would provide a continuous source of information of great value for dissemination amongst pastoralists, dairy farmers, wheat farmers, orchardists, and others, and prove the greatest factor in progress.

We have increased our knowledge of cultivable areas. Let us increase the productivity of our soil. The establishment of the Agricultural College at "Muresk" will tend towards this, and mark an epoch in the agricultural history of the State. It is safe to say that as a result of this institution the wealth of the community will increase may fold through the application of science to agriculture. Science is an accumulation of facts. The College will gather proved facts and methods, making them known to every farmer who is sufficiently interested to seek the information. All this must follow the ideals set up by those responsible for the institution which is to be opened this year; ideals aptly summed up by a recent writer in the following words:—"The main function of the College in teaching students would be to act as a clearing house for the knowledge gained by successful farmers and others throughout the State, and applying scientific methods to our climatic and soil conditions . . . . To do this an Agricultural College must keep in close touch with the work of scientific investigators elsewhere; otherwise there is a danger that its teaching will get into a groove. Contact with progressive ideas can best be maintained by keeping investigation and research constantly before the students. To do this some, at least, of the teaching staff should be enabled to devote their time to research, the most fruitful source of new methods and ideas, as Farrar's wheat-breeding has proved."

CEREAL SMUTS.

W. M. CARNE,
Botanist and Plant Pathologist.

The cereal smuts are of two types:—

1. *Flag Smuts.*—Represented in this State by Flag Smut of wheat and characterised by the production of smut on the leaves.

2. *Head Smuts.*—In these the ears or grains are affected. They may be divided into two groups according to the manner of infection.

   (a) *Seedling Infecting.*—Represented here by Ball Smut or Bunt of Wheat, Oat Smuts, and Covered Smut of Barley.

   (b) *Flower Infecting.*—Including Loose or Flying Smut of Wheat and Loose Smut of Barley.

FLAG SMUT OF WHEAT.

(*Urocystis tritici.*)

This disease has been dealt with fully in this Journal (June, 1924) and additional notes only are here included.

Probably owing to the lateness of the effective rains in 1924 the prevalence of this disease was much less than in 1923. No report of its occurrence in serious quantity was received. Late sowing or late germination are both unfavourable for flag smut.

The most striking observation which has been made during the past three or four years is the apparent resistance of Nabawa. We have no record of the disease occurring in that variety, even when grown in the same paddock with affected varieties. It has also been known to produce a clean crop when grown after one affected crop and before another affected crop in the same paddock. Pot trials last season with 11 varieties in which chopped affected straw was sown with the grain gave positive infection in all cases except Nabawa, Florence, and Yandilla King. On the evidence available farmers are strongly advised to sow Nabawa in paddocks which have previously carried a crop affected with flag smut.

BUNT, BALL SMUT OR STINKING SMUT OF WHEAT.

(*Tilletia levis and Tilletia tritici.*)

This disease, the most important of all the smuts, is a head smut infecting the plants in the seedling stage.

It will be noted that two fungi are quoted above as causing this disease. There are in fact two distinct diseases, but as the differences in the main are purely technical, the two may be treated as one. As a matter of fact *Tilletia levis* is much more common here than *Tilletia tritici,* which has only been noted by the writer twice in the past two years. There is a field difference between the two, the later causing a stunting of the affected plants not usually noticeable with the former.

Symptoms.—Bunt is characterised by the formation of smut or bunt balls in the ears instead of grains. Bunt balls (Fig. 1) are greyish-green, and readily distinguishable from wheat grains. They are usually shorter, stouter, and lighter in weight. They have a characteristic odour, very offensive, and suggesting decaying fish. When broken, they are found to contain a greasy black mass which readily breaks up into a fine powder.

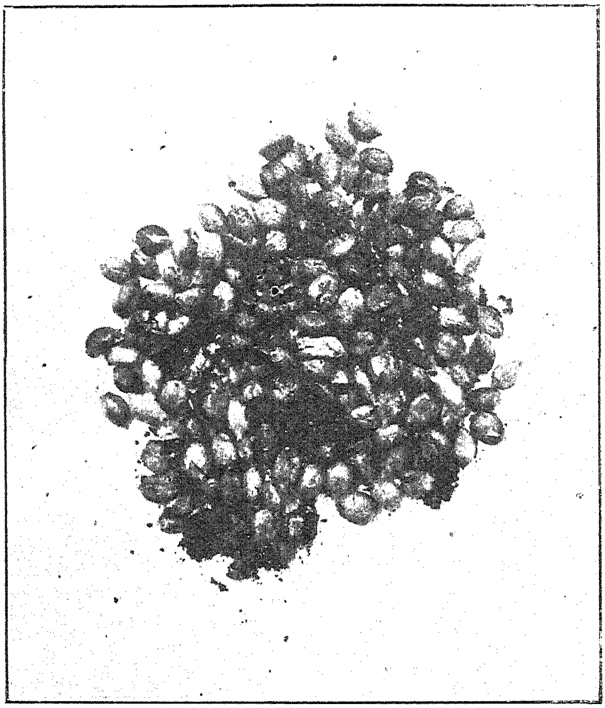


Fig. 1.—Smut Balls.

Affected plants tend to be a darker green than clean plants. Affected ears (Fig. 2) are more open, the glumes or chaff of the spikelets (or sections of the ear) being spread apart by the bunt balls inside. Bunted plants tend to mature earlier than normal plants of the same variety. All the ears of a plant may be bunted. More frequently only a proportion, especially on secondary growths, are affected, and the remainder appear quite normal. Again bunt balls and sound grains sometimes occur in the same ear. A few cases have even been recorded in which portions only of individual grains have been smutted.

Loss due to Bunt.—The loss resulting from this disease is twofold in character:—

1. Bunted grains are valueless.

2. Sound grains containing bunt balls are depreciated both for seed or milling according to the amount present. No sane person will willingly plant

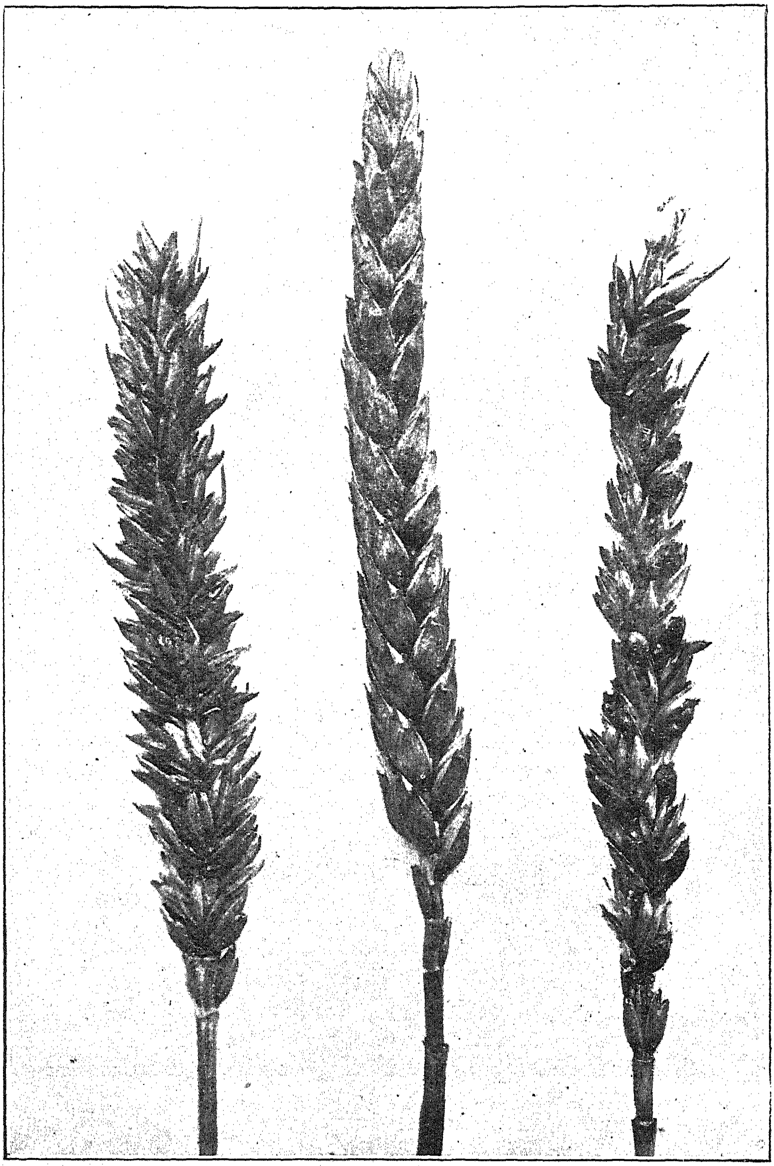


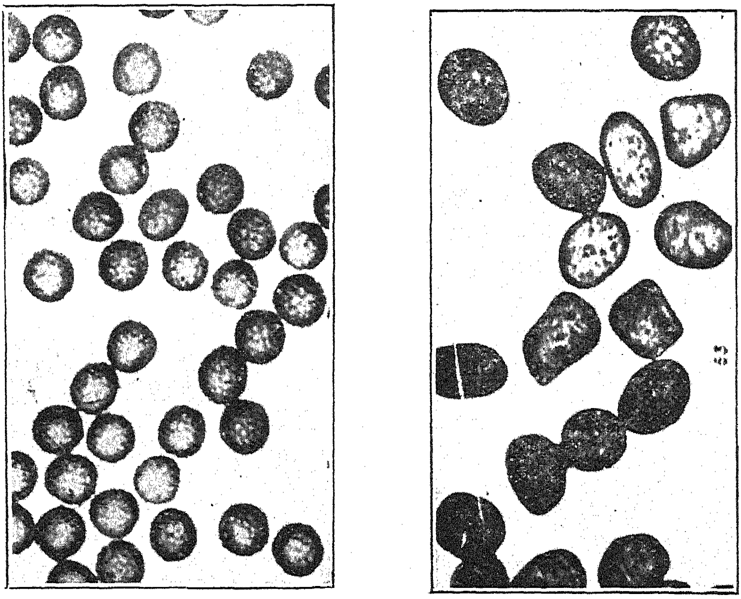
Fig. 2.—Ball or Stinking Smut or Bunt. (Smut free ear in centre.)

wheat obviously badly affected with bunt. For milling purposes bunted wheat is a nuisance. Its presence gives such a bad colour and bad odour to flour that the miller has to process and deodorise affected samples, and naturally he is not prepared to pay the price commanded by clean wheat. Badly affected samples cannot at reasonable cost be rendered fit for milling, and must find their way to the feed market. Were the bunt balls unbroken the

difficulties would be less, but in passing through the threshing drum of the harvesting machinery may of the balls are broken, and the fine black dust distributed over the sound grain. The principal loss to the farmer from bunt is therefore not the loss of grain but the dockage justifiably imposed on the good grain containing bunt balls.

The use of Bunted Grain for Feed Purposes.—The use of bunted wheat for feeding poultry and stock requires some care. If taken in large quantities bunt is poisonous, setting up gastric and intestinal troubles.

Development of the Disease.—As previously mentioned ball smut may be caused by either of two fungi. Their life histories are so similar that we may treat them as identical.



Tilletia tritici. Tilletia levis.

Fig. 3.—Spores of the two species of Ball Smut—highly magnified. (After McAlpine.)

Let us commence at harvest time in a crop containing smutted plants. When the grain is bagged it will contain smut balls. Many of the grains will certainly be dusted with the black smut powder. In passing through the threshing drum some of the bunt balls have been broken and the powder scattered through the wheat. One ball alone contains upwards of six million grains of this powder, so that there are plenty to go round. When well mixed up, unless the smut is very plentiful, its presence on the seed may pas unnoticed to the naked eye, as each little smut speck is microscopical in size. During the subsequent handling up to and during the drilling of the seed in a following season further opportunities may occur to break more smut balls and further distribute the smut dust amongst the grain. Each particle of the smut dust is a spore (*chlamydospore*) (Fig. 3), a structure correspond-

ing to a seed in ordinary flowering plants. Let us assume that no treatment is given to the seed, and that in due course it is sown with its accompanying smut spores. If the conditions are favourable both seeds and spores germinate. The spore pushes out a short growth (*promycelium*) at the end of which

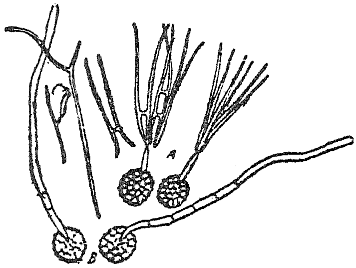


Fig. 4.—The germination and development of a Smut Spore.
(After Tubeuf.)

is formed a cluster of thin spores (*conidia*), which unite in pairs. (Fig. 4). From each pair is produced a smaller sickle-shaped secondary conidium, and it again may produce another or tertiary conidium. Infection of the wheat plant takes place from delicate thread-like growths, from the secondary or

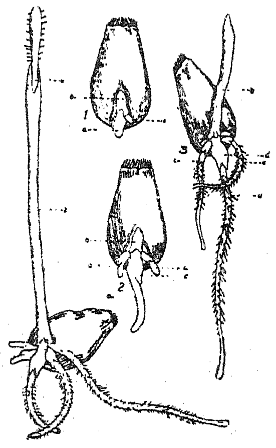


Fig. 5.—Various stages of germination of wheat during which infection by the spores of Ball Smut take place. (Ottawa Bull. 73. Drawings from Diagrams in Kensington Museum.)

tertiary conidia, which are able to attack the very earliest growth from the wheat grain. The young growth is open to attack from the commencement of germination of the grain until the first leaf commences to appear. (Fig. 5). The fungus grows internally in the plant keeping well up to the growing points. In due course the wheat flowers, the fungus enters the undeveloped

seed and occupies the whole of it. Later the fungus breaks up into innumerable black spores within the seed coat, thus forming bunt balls.

Some Notes on Bunt Infection.—While we know that the presence of smut spores is essential for the production of bunted wheat plants, or in other words that clean seed produces clean wheat, it is not always easy to explain why bunt occurs more or in one season than another or on one crop than another.

It is the practice at the State Experiment Farms to annually conduct tests of the resistance of various varieties of wheat to bunt. The actual fungus used is *Tilletia levis*. The following notes have been compiled by Mr. E. J. Limbourn, the officer in charge of such investigations at the Merredin Experiment Farm, and are the result of his observations over several years:—

"The seed used for this Smut Resistance Test is first thoroughly infected, the grains when planted being quite black with smut spores. After infection the grains are planted by hand in rows, each containing 100 grains of one variety, usually from a single plant. All varieties to be included in the test, whatever the period of maturity, are planted on the same day. Planting is deferred until after the first good rains, so that both grain and spores may germinate together, ensuring a maximum amount of infection. By planting all varieties at the same time no one variety or set of varieites has any advantage over another as far as condition of soil, cultivation, etc., are concerned. In spite of this some varieties show every year decidedly more resistance than others. Even with the most liable varieties there are always a few plants which mature only clean grain.

"From observations made it would appear that there are three main reasons for the difference in the resistance of different varieties. They are:—

1. A constitutional factor giving high resistance.
2. Climatic conditions, and
3. Soil conditions which in many cases are closely allied to or dependent on 2.

"*Constitutional Factor.*—It is a well known fact that some varieties are more resistant than others, a few such as 'Florence' being practically smut proof. It has also been proved that this resistance is an inherited factor, and by cross-breeding from resistant varieties new varieties can be formed equally resistant. There are now several unnamed varieties under test at the Experiment Farms equally as resistant as 'Florence.' From an examination of the grains of these resistant varieties it would seem that this factor of resistance is in some way related to the hard translucent quality of such grain. It will be found that all the highly resistant varieties have hard bright grains or are derived from varieties having that quality. 'Carabin' is a good instance of this, its parent varieties being 'Florence' and 'Cedar,' both of which have hard grains.

"*Climatic Conditions.*—There is little doubt that many, probably most, of the plants in the test are infected with the disease. It depends largely upon the climatic conditions whether this infection will result in the production of bunt balls. In 1922 we had a very variable season. May was very wet, June exceptionally dry, and then followed very fair rains in July. The test

was planted during May, and good growth was made with the wet weather. With the dry spell in June 'Florence,' a very early variety, began to send up ears prematurely. Then with the July rains there was considerable secondary growth. In the secondary growth bunt balls were found, the primary growth being quite clean. This again occurred in the later varieties in 1923. The September rains following the dry August caused secondary growth in these, and in many instances the only smut found was in the secondary growth. It is indeed always found that the secondary growth is more liable than primary. In 1924 conditions for infection were very good, and the test proved one of the most severe so far carried out. The very cool temperatures during the winter months and well into August resulted in very slow growth. With the dry period during July, and with the subsequent fairly good rains during August and September, there was considerable secondary growth, which carried the greatest number of affected heads. This applied more especially to the more resistant varieties.

"*The Condition of the Soil.*—Another thing that affects the occurrence of the disease is the presence of water-logged hard-setting patches of ground. It has been noticed that wherever plants are growing on hard patches or depressions where water had lain, they are not only stunted in growth but are also smutted. No matter how resistant the variety might be naturally, more or less of the ears contain smut balls."

All the facts concerning the occurrence of bunt are not known. The following information gathered from various sources will help to explain Mr. Limbourn's observations:—

Infection of wheat can only take place from the spores of either *Tilletia levis* or *Tilletia tritici*. The most favourable position of the spores for infection is on the seed when planted. The more spores on a seed the greater the chance of the resulting plant being smutted.

Spores germinate readily under favourable soil conditions. Kept dry they may survive in unbroken bunt balls for upwards of 12 years. In the soil, under Australian conditions, it is probable that few survive one year.

The optimum (best) temperature for spore germination is about 63 deg. F. Temperatures below 40 deg. and above 70 deg. are unfavourable to germination. The optimum temperature for wheat germination is about 77 deg., but it will germinate, though more slowly, at temperatures as low as 36 deg. and as high as 90 deg.

The amount of soil moisture required is approximately the same for both wheat and smut germination. In very wet soils, with consequent shortage of oxygen, smut appears to be affected more than wheat.

After germination death of the fungus occurs in a few weeks if it is unable to come in contact with wheat in a susceptible stage. Wheat is susceptible to infection from the commencement of germination to the appearance of the first green leaf. This period is usually about eight to 10 days, but may vary with the depth of sowing, soil moisture, temperature, and the use of bunt treatments.

After infection the fungus develops in the wheat plant without obvious injury to it. If it reaches the growing points of the plant and maintains its position there, such growing points eventually produce smutted heads. If it fails to reach or maintain its position at the growing points the heads are

not smutted, and there is no visible evidence of infection. In an intermediate condition only certain of the heads, usually those on secondary growths, are affected.

Resistance is not understood, but that varieties do differ in their liability to attack is undoubted. The different races of wheat vary in this respect, the Durums or Macaroni wheats being less liable than the common wheats, though crossbred wheats between the common wheats and resistant races may be resistant. All wheats appear to be equally liable to attack. In the resistant varieties the fungus appears unable to flourish under normal conditions, some factor resisting its growth. This type of resistance is inherited, and new resistant crossbred varieties may be obtained if one or both the parents are resistant. Florence is an illustration of a variety so bred.

Some wheats may avoid severe infection (smut-escaping) under normal conditions if their period of susceptibility is shorter than normal. Unfavourable conditions causing slower germination would increase their liability.

The common occurrence of clean plants from badly smutted seed may be due to one or more of the following factors:—

1. The wheat may be naturally resistant.

2. Rapid germination may cause the danger period to pass before infection takes place. The temperature and soil moisture may be more favourable for the germination of wheat than smut spores. Soil temperatures over 75 deg. would tend to have this effect.

3. Conditions may be so favourable for the rapid growth of wheat that the fungus fails to reach the growing points.

From the foregoing notes it may with probability be concluded, assuming that the seed has not been treated for smut:—

1. That clean seed will produce clean crops.

2. That self-grown seed is likely to produce clean crops, as the seed will be clean in most cases. It is in the processes of harvesting and winnowing that the bunt balls are broken and the spores get on to the grains. Germination temperatures may be more suitable to wheat than smut (See 3). The cleanliness of self-sown crops is a matter of common observation.

3. That early sowing in soils containing sufficient moisture to germinate the wheat should be accompanied by low infection owing to the high temperatures favouring wheat rather than the smut.

4. That sowing in dry soils is likely to be followed by high infection, as both wheat and spores will probably germinate together following the advent of rain.

5. That sowing after the autumn rains have commenced is liable to produce high infection for the same reason as given in 4.

6. That sowing in badly drained soils or under other conditions unfavourable to wheat is liable to be followed by high infection owing to the slow germination and slow growth of the plants. Should the soil become very wet just after sowing it is possible that infection may be low, as such a condition may be more detrimental to the smut than to the wheat. In addition to the effects mentioned, unfavourable conditions for growth may actually affect the resistance even of resistant varieties. Mr. Limbourn has noted the increased liability under unfavourable conditions of the resistant variety Flor-

ence. In America, where there are two seasons for wheat sowing, it has been noticed that Florence and Marquis, when autumn sown, are less resistant than when spring sown—the best season for these varieties.

TREATMENT FOR SMUT PREVENTION.

While it is a fact that clean seed will produce clean crops, it is practically impossible to detect whether seed is free from bunt spores or not. Where the crop from which the seed was obtained was definitely known to be clean, it is safe to use such seed without treatment. Badly affected grain can be detected by both sight and smell, but when the infection is only moderate microscopic examination alone can say the seed is clean. As practically all infection takes place from spores on the seeds it is possible to prevent infection by killing these spores.

Three methods of seed treatment are in general use in Australia. Various proprietary preparations have been advertised, but these offer no special advantages over the usual methods and are not recommended. Of the three common methods in use the Department strongly advocates the dry treatment with copper carbonate in preference to either bluestone or formalin methods.

Bluestone Method.—As usually practised this consists of dipping the grain for 3-5 minutes in a solution of bluestone (copper sulphate), made by dissolving 1½ lbs. in 10 gallons of water. This dipping may or may not be followed by another in limewater or milk of lime.

The defects of this method, which is very effective against bunt, are as follows:—

The dipping does not kill the spores in the unbroken bunt balls. If these are not removed by skimming off the surface of the solution while the seed is stirred, they may cause re-infection if broken later.

The seed is wetted and must be dried as soon as possible and sown soon after treatment.

Bluestone causes a variable amount of damage to the seed, and delays and even prevents germination. This damage is only partially removed by dipping in lime water. The damage results from the solution penetrating the seed coat through cracks, usually minute, which almost invariably occur under our system of harvesting dead ripe grain.

Formalin Method.—This consists of dipping the seed for three to five minutes in a solution made by adding one pound of formalin to 40 gallons of water. It has the defects of bluestone in regard to wetting the seed and the removal of the bunt balls. Treated seed must be dried sufficiently and sown as soon as possible, as injury from formalin increases as the seed dries. The injuries are of two types. In the first place the seed coat is hardened, making it difficult for the seed to germinate and consequently delaying germination. In addition the absorption of the formalin gas which develops from the minute crystals of paraformaldehyde which form on the seed coats of the treated grain when dry causes a poisioning and more or less direct injury. The injury is reduced if sowing in moist soil occurs shortly after treatment. Delayed sowing or sowing in dry soils increases the injury. A further drawback to formalin is that it is less effective than bluestone in guarding against re-infection from bunt balls broken in the bags or the drill.

Copper Carbonate or Dry Treatment.—This consists of covering the grains with a fine impalpable powder containing copper carbonate. If the

powder is up to standard it will be found that two ounces is sufficient for each bushel of wheat.

The standard for copper carbonate dust as determined in California is as follows:—

It should contain 52-54 per cent. of copper carbonate and 39-42 per cent. of copper hydrate, totalling 93-94 per cent. of these two. It should have a density of not over 32lbs. per cubic foot, and be fine enough for 99 per cent. in aqueous solution to pass through a 200-mesh sieve. The colour should be light green, never blue. It is as effective as bluestone or formalin in controlling bunt, and has several advantages of those methods.

Treatment may be carried out at any time without any effect on the grain. The grain is not wetted and consequently runs through the drill more readily. Re-infection is impossible as the powder is not effective until the grain is sown and the soil is moist, that is, it acts upon the spores as the wheat commences to germinate. In consequence the presence of small amounts of bunt balls is immaterial. Germination is not affected. Indeed the grain is protected from various minor fungi in the soil which usually kill a percentage of the young plants.

The drawbacks to copper carbonate are several. Firstly, it is somewhat more expensive than bluestone or formalin; secondly, it is necessary to use some form of closed mixer to ensure the proper dusting of the seed. Such an apparatus can be readily constructed on the lines of a box churn. A number of machines for the purpose are on the market, which are quite effective. The third defect is that care must be taken not to inhale the dust when mixing or drilling as it is irritating and poisonous. The advantages are so great, however, that this system, which had its origin in New South Wales, is now rapidly replacing all others in Australia and in North America.

GENERAL NOTES ON BUNT TREATMENT.

It is the excellent practice of many farmers to sow special plots with high quality seed on specially prepared and selected soil for seed only. Such seed is carefully treated for bunt, and the resulting smut-free crop is then available for sowing in the main crop of the following season without treatment.

This is a justifiable saving, probably representing 90 per cent. of the cost of treating all seed sown.

SUMMARY.

Bunt results from attacks of two species of fungi.

Bunt causes loss to the farmer by—

(a) Reducing grain yield.

(b) Reducing the commercial value of the grain.

Infection takes place from spores on the seed.

Dry sowing is liable to increase bunt infection in crops from untreated seed.

Bunt may be controlled by seed treatment with bluestone or formalin solutions of copper carbonate dust.

The dry treatment of wheat with copper carbonate is the best method of protecting crops from bunt.

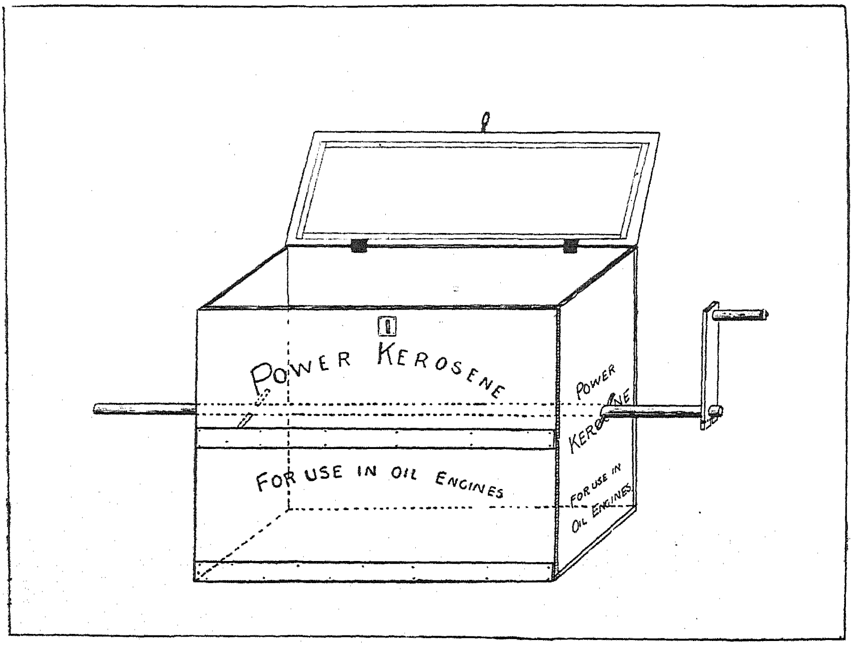
Clean crops will produce clean seed, which may be sown without treatment.

A SIMPLE DRY PICKLER.

GERALD L. THROSSELL, Dipl. Agric.

One of the reasons why many farmers have not adopted the dry pickling with copper carbonate powder, which has been proved to be so much superior to the bluestone and formalin solutions in the prevention of smut, seems to be the higher cost of many of the machines which are at present on the market. There are many settlers who say they cannot afford to make the outlay for a machine which is only used for two or three days in the year, and in consequence do not pickle their seed, which results in smutty crops.

For the past two seasons at the Merredin Experiment Farm pickling with bluestone and lime solutions has been abandoned in favour of the dry copper carbonate method. Each season over four hundred acres of wheat treated in this manner have been sown, and the results have been highly satisfactory—the crops being free from smut.



A farm-made pickler.

That there is no reason for a farmer to adhere to the obsolete wet methods —or not to pickle at all—simply because he cannot afford to purchase a dry pickling machine is shown by the accompanying sketch of a dry pickler which was contrived at the Experiment Farm, and which was used last year for treating the farm seed.

It simply consists of an ordinary kerosene case, rendered dust-proof by sealing the cracks with boards, fitted with a hinged airtight lid fastened with a catch. A piece of inch water-piping was used as a spindle, protruding six

inches from each end, as illustrated. The box was kept rigid on the spindle by means of a quarter-inch round pin at each end. A simple wooden handle fastened to one end completes the apparatus. The pickler was supported on two carpenter's trestles, but two forked posts would be sufficient.

The capacity of the box is about half a bushel, being approximately two-thirds full. Copper carbonate is used at the rate of two ounces to the bushel, and a measure was made which would hold enough carbonate for each pickling. By closing the lid and revolving the box for a minute and a half the wheat was thoroughly dusted with copper carbonate powder.

The quantity dealt with was obviously less than with the machines on the market, but it is believed to be quicker than the wet method unless special appliances are used. It is not suggested that this type and size of pickler is recommended, but it is merely given to show that this dry method of pickling is within the reach of all. It is thought that a box made to hold half a bag would be quite suitable for the average framer.

"BURT'S EARLY" OATS.

(Grown by J. K. Hebiton, Three Springs.)

The above crop was grown on new land (originally carrying York Gum and Prickly Scrub). Ploughed with the Sundercut and planted in April, the fine yield of 50 bushels per acre, over a 60-acre paddock, was obtained.

"Well and correctly branded."

BRANDING THE WOOL BALE.

GEO. L. SUTTON, Director of Agriculture, and N. DAVENPORT, Agricultural Cadet.

Many bales are well and neatly branded, but few are correctly branded. This fact will come as a surprise, if not as a shock, to the majority of wool growers, but an examination of the wool displayed on the show floor of any of our brokers will disclose what a very small percentage of the clips displayed are correctly branded. It is generally recognised that a bale should be branded in two places, and most bales are so branded, but rarely indeed are *both* the brands suitably placed and in such positions that the bale can be described as correctly branded.

Many growers take a pride in the "get-up" of their clip, and this extends to the branding of the bales. They want their bales to be "smart," for, quite apart from the commendable pride which they take in their clip and the way it is sent to market, they often appreciate the value which attaches to a properly and attractively branded bale, indicating to outsiders as it does some measure of the care taken with the preparation of its contents for sale. The majority of wool pressers who brand the bales are also anxious to turn out a "smart" bale, for they are desirous of showing by their good workmanship that they are masters of all the details of their craft. It is, therefore, apparent that the incorrect position of the brands on the bales is not due to carelessness or want of interest, but rather to a lack of understanding of what are the actual requirements of a well and correctly branded bale.

The brand consists of three parts, these are—

(a) The owner's mark or name of the holding, *e.g.*, MYARA.

(b) The abbreviated description of the contents, *e.g.*, PCS, and

(c) The number of the bale, *e.g.*, 4.

A well branded bale will have the whole of these details distinctly marked on two places, viz., on one side and on the top, with each detail in its relatively correct position on each portion.

The brand on this side, which then becomes the "front" of the bale, should be placed so that the name of the holding is about the centre of the bale, with the letters which form the abbreviated description of the contents just below the name. When in this position the details are still visible to the buyer when the top of the bale is opened (and the flap turned in) for inspection. The advantage of this will be seen from the illustration.

The top brand should be placed on the front flap with the name of holding or homestead and other details in similar relative positions to those which they occupy on the "front" of the bale.

It is quite unnecessary to have more than the name of the holding, homestead, or owner's mark of a simple style to indicate the ownership of the bale. If an owner's mark or symbol is used, it must not contain figures, as instances are not unknown where these have been confused with the bale numbers. Some owners, in addition to the name, also brand their bales with their registered sheep or cattle brand. This is wrong and also objectionable. The

correct method of using only the name of the station or homestead is very satisfactory, very general, and has so much to recommend it that it ought to become the universal practice.

Incidentally it may be stated that the word "Myara," which is used on the bales in the illustrations is derived from "MYAR," which means "a house" or "a homestead" in the Western Australian aboriginal dialect.

The name of the Holding should be placed about the centre of the bale.

Certain abbreviations are now used to correctly describe the contents of the bales. These are *recognised* in the wool trade, and are used in brokers' catalogues, they should be adhered to by the grower, and such as meet the individual requirements of the bale should be branded on it.

The recognised abbreviations are—MO, for Merino; XB, for Crossbred; CBK, for Comeback; COR, for Corriedale; LIN, for Lincoln; LSTR, for Leicester; BOR LSTR, for Border Leicester; ROM, for Romney; DORS, for Dorset Horn; SHROP, for Shropshire; DBLE, for Double; H, for Hoggets; W, for Wethers; E, for Ewes; R, for Rams; FLC, for Fleece; BLK, for Black; LBS, for Lambs; BKN, for Broken; NKS, for Necks; PCS, for Pieces; BLS, for Bellies; BKS, for Backs; STD, for Stained; LKS, for Locks; SCD, for Scoured.

At one time numerals 1, 2, and 3 were used to indicate first, second, and third classes of wool, but these led to confusion in handling and shipping the bales, the numeral indicating the class being often mistaken for the number of the bale, hence the letters A, B, C are used to indicate the description of each class of wool bales. For the best quality the letter A is used, other descriptions ranging downwards in the order given. Sometimes two or three of the same letters are used on the bale to indicate better quality and condition *as far only as that particular clip is concerned.* Thus AA would indicate superiority to A, and AAA to AA in the same clip. *But A in one clip may be quite equal to and even better than AAA in another clip.*

The letters in the abbreviated form of description are not used to indicate certain definite permanent standardised quality counts, viz., 56s., 60s., or 70s., but as previously stated, and now emphasised the letter or letters used (one or more) indicate the relative grade or class of the wool on which they are used, and relate *only* to that particular clip. The more careful and skilful the breeder in securing flock uniformity, and the better the classer, the fewer indicating letters will there be on the bale.

The use of more letters than are necessary to briefly describe the contents of a bale does not increase the value of the wool in the slightest degree, nor do numerous letters deceive or influence the buyer or broker regarding the value of the contents. On the other hand, the use of unnecessary letters is wasteful, for it increases the cost of every operation, commencing with the marking of the bale and including the printing of the catalogue and invoicing and despatching the proceeds. Every additional letter also adds considerably to the work of the buyer when dealing with his documents. It is largely because of this continued difficulty from shed to destination in connection with brands or marking that abbreviations are used. *It is, therefore, desirable to use as few letters as possible,* and so increase the efficiency of all concerned.

A bale branded MO will realise just as much as a bale branded AAAMO, provided the contents in each case are similar. It is the wool inside the bale, and not the letters on the outside, used to describe it, that determines the value. Evidence, if necessary, of this is furnished by an examination of brokers' catalogues where in "interlotted" lots bales branded AAMO will be found associated with and bringing the same price as those branded only MO.

The number should be placed slightly to the right hand side of the centre stripe and a few inches from the bottom. This is to prevent it being hidden by the iron band which encircles the bale when it is dumped, and, further, it is more distinct than when branded on the blue of the stripe.

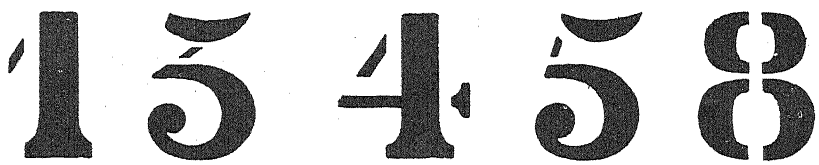
Not all shapes of numerals are suitable for numbering bales. This is because during transport portion of the number becomes unavoidably chafed. When numerals of a certain shape are used considerable confusion arises if

portion becomes chafed. Such numerals when newly made may be quite distinct from all others, but when chafed or faded can easily be mistaken for some other. For example, the figure three of the type 3 is quite distinct when first made, but if the top bar becomes faded as the result of exposure or of being chafed it becomes 5, which is then as likely to be taken for a

INCORRECT DIAGRAM FOR STENCILS

NUMERALS MOST LIKELY TO CAUSE CONFUSION

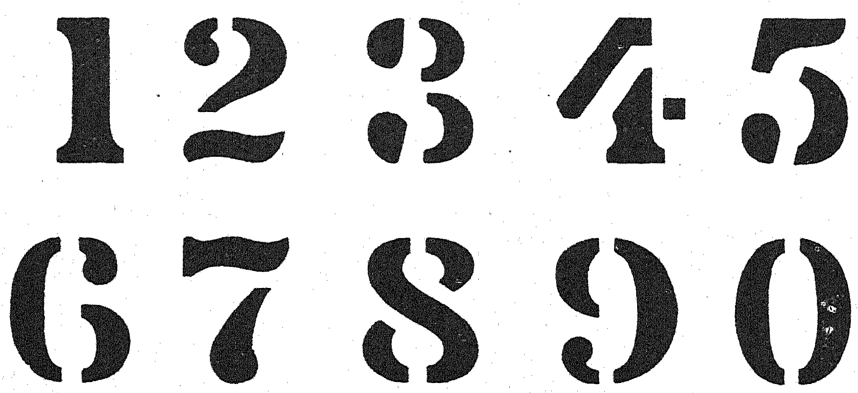
REJECT THESE



CORRECT DIAGRAM FOR STENCILS

NUMERALS LEAST LIKELY TO CAUSE CONFUSION

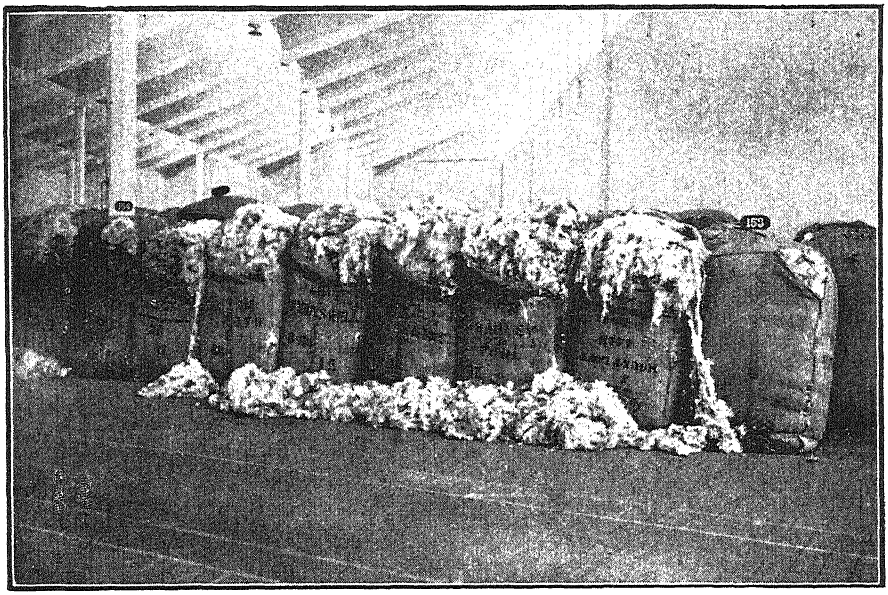
USE THESE



mutilated five as for a three, or the same confusion is likely to occur if the upper vertical stroke becomes faded or chafed. If, however, the three is of the type 3 the risk of mistaking it for a five is considerably lessened even if part does become obliterated. The numerals most likely to cause confusion are shown herewith, as well as the set which experience has shown is likely to lead to least confusion.

Having discussed what constitutes a well-branded bale, it is now advisable to consider where this brand should be placed in order that the bale shall be correctly branded. As already stated each bale should be branded in two places, viz., on the "front" and on the front flap.

The brand and marking on the front of each bale is necessary so that it can be seen by the buyer or broker when inspecting the contents for valuation, for which purpose sample bales are placed side by side in rows on the broker's show floor, as in the illustration, in which "interlotted" bales of farmers' wool are shown. The first bale in this lot, though well branded, is not correctly branded, for the side which, of necessity, becomes the front, has no brand on it.

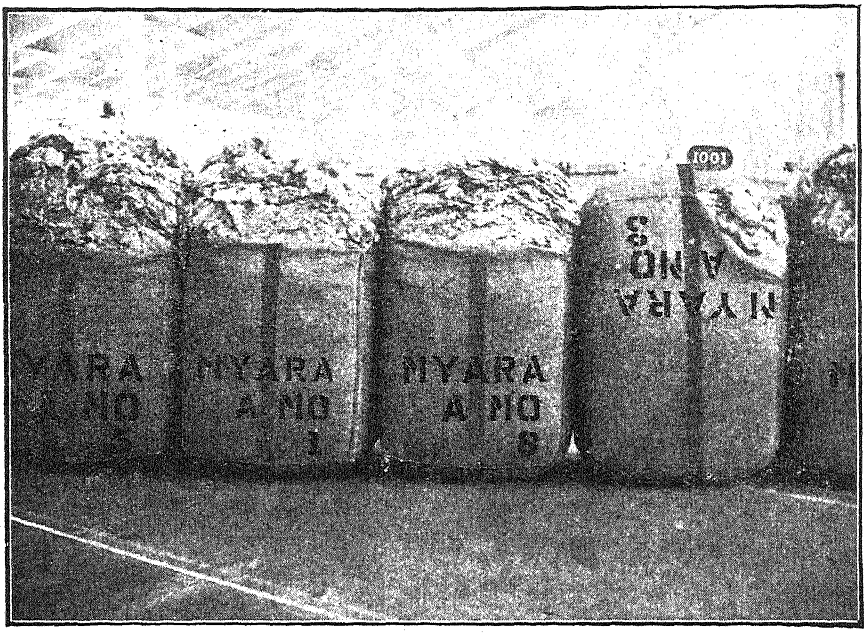


An "interlotted" lot displayed for sale.

The brand, description, and number on the top of each bale is also essential, so that it can be readily seen when the bales are stacked upon each other in the wool warehouse awaiting allotment for sale. Every grower's clip is stacked separately, bale upon bale, in what may be called streets or alleys with the branded tops placed towards and showing in the alleyway. Stacked in this way any required bale can be identified and removed from the bulk stacks to the show floor immediately when required.

There is also an additional reason for having the bales branded in two places. During transit from the farm or station, brands on bales frequently become chafed and faded, and at times obliterated. By having the brands correctly marked on the top and also on the side, one or other of them is usually preserved, thus maintaining the identification of the bale and preventing loss and confusion to all concerned.

The first step necessary to ensure that the bale shall be correctly branded is to arrive at a right decision as to what is the "front." This is the side on which the brand is placed. Most growers consider that any one of the four sides is suitable for this purpose, and this is the fundamental mistake which results in incorrect branding. Any of the sides would be suitable but for the regulations which govern the display for samples on the show floors. These require that if the "lot" consist of five bales three shall be shown, or all bales if the "lot" consists of three or fewer bales. They further require that the first o. the bales shown shall be placed upside down, as in the "lot" illustrated, so that it can be opened at the bottom and the contents at that



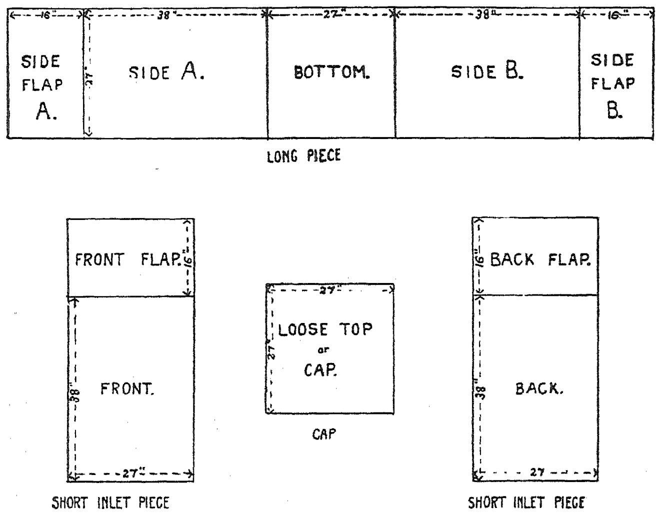
A lot displayed for buyers' inspection, as required by the regulations.

end examined by the buyer. In order to prevent permanent injury to the wool pack the "front" can be only one of either of two sides.

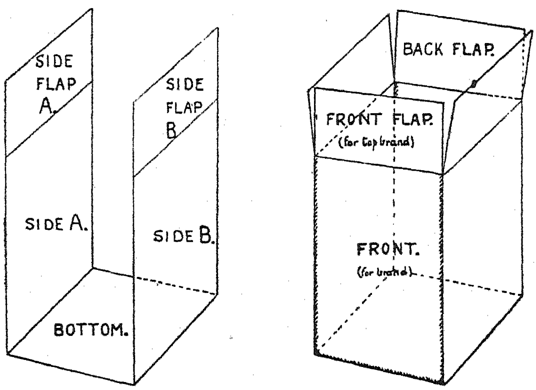
To understand why this is the case, and which of the sides can properly act as the front, it is necessary to call to mind the construction of the wool pack. If one be examined it will be seen, as is shown in the diagram herewith, to consist of four pieces, one "long" piece sufficiently long to form the bottom and two sides with their flaps, two others which form respectively the front and back and flaps, and the loose top or "cap." The pack is formed by placing the "long piece" around the two short pieces and sewing these to the bottom and up the two sides of each. These short pieces may be said to be "inlet" or "inset" into the long piece up to and as far as the lower edge of the flap. Seeing that this short "inlet" piece is sewn into the other side of the bale, it affords a means of cutting along the seam whereby the bale can be opened at the bottom without injury to the material of which

the pack is made, and afford the necessary facilities for inspection. When opened at the bottom on this side the cut-open seam can be resewn after the inspection of the wool is completed, and the bale is then as good as it was

THE PARTS AND CONSTRUCTION OF A WOOL PACK.



THE SEPARATE PARTS OF THE PACK.

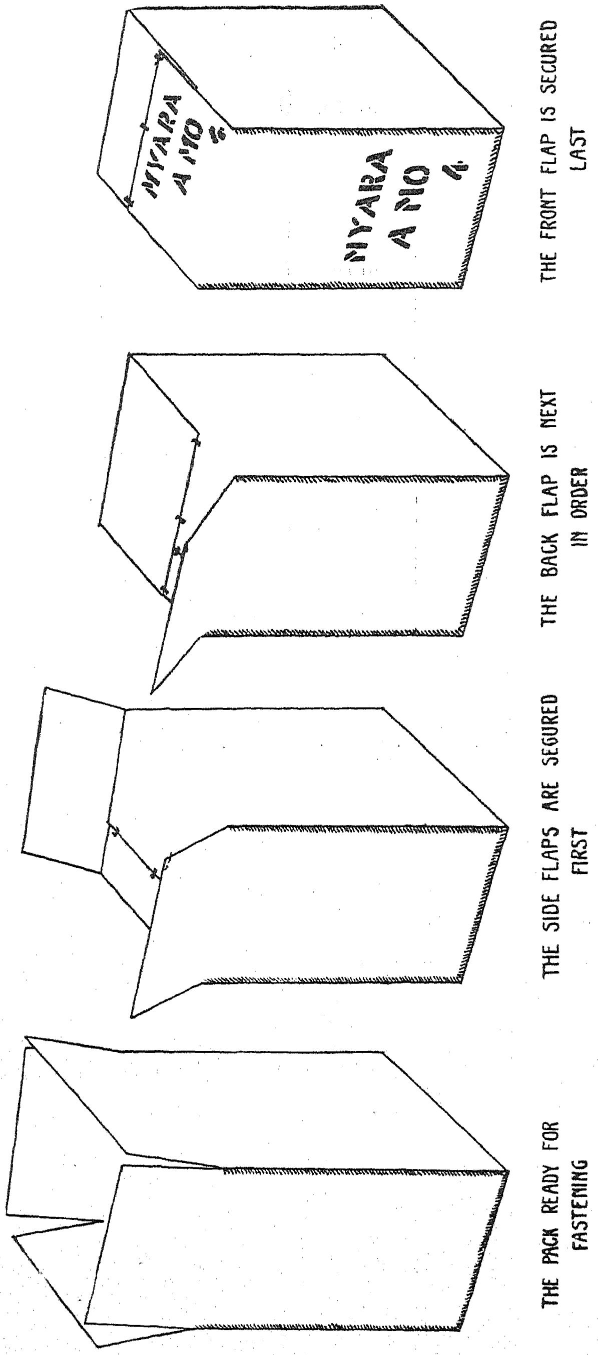


THE LONG PIECE READY TO RECIEVE THE SHORT INLET PIECES.

THE WOOL PACK FORMED WITH THE INLET PIECES SEWN IN.

THE CONSTRUCTION OF THE PACK.

before being cut open. It is obvious, therefore, that the front of the bale should be one of the two "inlet" pieces. In the diagram they are accordingly marked "front" and "back" respectively, and are interchangeable in this connection.

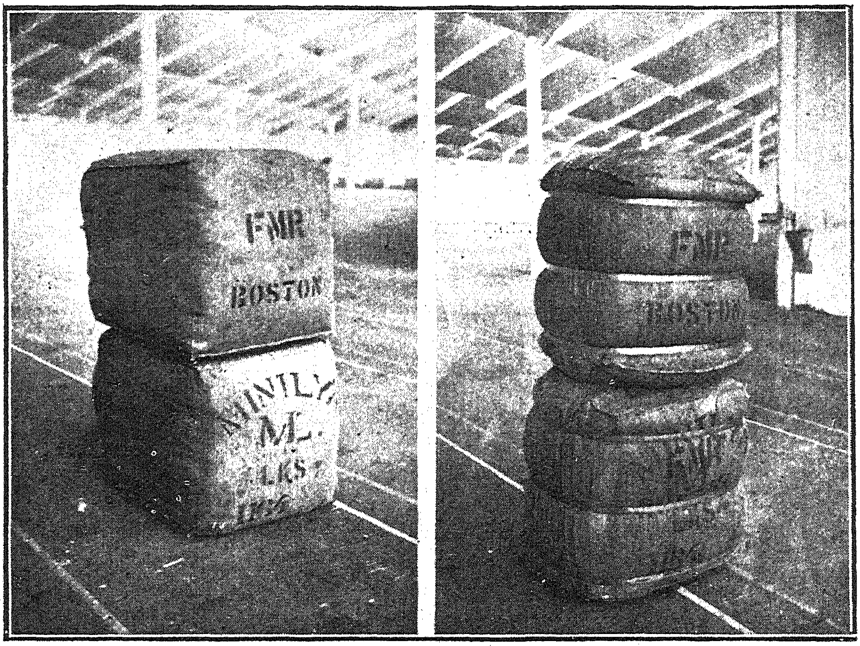


THE CORRECT ORDER FOR SECURING A WOOL PACK

The top brand should be placed on the flap, which is the continuation of the "front."

Very often when the brand is placed on the proper "front" of the bale, the top brand is improperly placed on one of the side flaps, and in consequence the top brand is at right angles to the front brand. This is obviously wrong, both brands should face in the same direction, and, therefore, the top brand should be placed on the front flap. In order to ensure that this is done it is necessary, after the "cap" is secured, to see that the flaps be fastened in the following order:—1st, side flaps; 2nd, back flaps; 3rd front flap. This procedure is illustrated in the diagram.

When it is the practice of the presser to fasten two of the flaps before the newly pressed bale leaves the press, the above order or procedure can be followed, with some presses, only when the wool pack is placed in the press with the "inlet" pieces to the side of the wool press and the long pieces facing the doorways. As there is no disadvantage in following this plan, it is sug-



The bottom of the bale must be left for the buyer's counter and port marks. Note the confusion when the bale is branded with grower's mark on the bottom.

gested that it be adopted at all times, and even when only the "cap" is secured before the bale is taken out of the press. However, whatever plan is followed care should be taken to secure the flaps in the order given, so as to have the front one secured last.

Just as there are two places on which the brand is placed on a well and properly branded bale, so there is one place in which it *must not* be put. This is on the bottom of the bale. This position is reserved for the buyer's

countermark and port mark of destination. The ill-effect of the grower's brand upon this countermark may be seen from the illustration.

To ensure that the brand shall be neat and distinct, clean and well cut stencils of block letters should be used. When ordering stencils owners should advise the maker that block letters are required, and that they must adhere strictly to the shape of numeral shown in the illustration, also to the abbreviations used for the descriptions, and, further, that the block letters and figures used should not be less than 3in. long.

The marking should be done only with *reliable black ink*. *Colours* must *not* be used, nor tar paint, tattoo oil, branding fluid, or any oil substance, as the grease from the wool makes the oily substance spread until it is unreadable. Tar is particularly objectionable.

In conclusion, it is pointed out that it is in the interest of the grower to not only have the bales well branded, but also correctly branded, for it is one of the outward signs of thoroughness on the part of the woolgrower, and tends to impart confidence to the buyer with regard to the careful packing of the contents, and may be the means of securing the last fraction of additional advance, which makes for records, and which is welcome remuneration for extra care exercised. Further, properly branded bales lessen the risk of loss which may result from confusion regarding the identity of bales improperly branded. Happily, owing to the great care exercised by our wool brokers, mistakes of this kind are not common. The risk does, however, obtain, and is an unnecessary one, provided the requirements for branding a bale correctly and well are realised and understood.

Summarised, the requirements of a well and correctly branded bale are:—

1. It shall have legibly marked on it—
   (a) The name of the holding, *e.g.*, MYARA.
   (b) The abbreviated description of the contents, *e.g.*, PCS.
   (c) The number of the bale, *e.g.*, 38.

2. Each bale shall be branded in two places, viz., on the "front," on the front flap.

3. The "front" shall be one of the two "inlet" pieces sewn into the pack.

4. To ensure that the brand be placed correctly on the top it is necessary that the front flap be secured last.

5. The bale must not be branded on the bottom.

6. The stencils must be "clean cut," and letters used of the block type and not less than 3in. long.

7. Only black ink should be used. Coloured ink or tar, paint, tattoo oil, or any oil substances are unsuitable.

POULTRY NOTES.

R. A. DUSTING,
Poultry Adviser.

To show a margin of profit at the present high cost of poultry food, the weeding of all unprofitable birds must be drastically carried out. Any male birds not required for breeding purposes, or for which there will be sale as breeders, and all weaklings or undeveloped young stock, together with hens that have shown a tendency to persistent broodiness, should be the first to go. This will allow more space and accommodation with better care and feeding to the pullets now in lay and close up laying, more especially as regards green food which, at this season of the year, is always scarce.

Many poultry farmers fail to recognise the influence of green food on the development of the young stock, and the necessity for at least 50 per cent. of the daily ration for laying hens to be composed of fresh succulent green food. Recent experiments exhaustively carried out at the College of Agriculture, Berkeley, California, prove conclusively that lack of sufficient green food is the primary cause of disease amongst poultry, affecting not only growth and stamina, but also the internal organs, and weakening the whole system, making it more susceptible and less resistant to any diseases that poultry are liable to contract.

In this State, owing to the long dry summer and scarcity of natural grasses, a lucerne patch of quarter of an acre to every thousand fowls is as indispensable as a regular suppy of wheat, pollard, and bran, and no poultry farmer can make the business a success unless he makes provision for this most important factor. Besides its health-giving qualities it reduces the feed bill and lowers the cost of production of the egg and poultry meat.

By eliminating the birds that are not showing a profit more space is available for the grading of the young stock of different ages and sizes. In many of the yards of budding poultry farmers I visit in my rounds may be seen chicks six weeks old battling for feed amongst five months old birds; they get insufficient food, are trampled on by the older birds, harrassed from all the shady comfortable spots, and sleep on the floor amongst the droppings and filth, and the owners inquire why they will not grow and are always getting sick.

Each hatch should be kept separate, and at two months old every hatch should be re-graded and evenness of size in every pen aimed at. It is of no use to say that are provided with ample food, the more robust birds harry the slower maturing chicks, who get nervous, stay on the outskirts and daily lose courage to fight for a sufficiency of food; they become weeds and weaklings and without sufficient stamina to produce the margin of eggs necessary to show a profit over cost of food. These weaklings represent a loss of the profit anticipated at hatching time, and such a loss can be considerably reduced if re-grading is carried out thoroughly, and instead of having 30 per cent. of backward pullets in March and April, when eggs are scarce and prices high, the percentage can be reduced to five per cent. by sorting out the smaller birds, pushing them along, and encouraging them to lay as soon as possible by giving them a variety of foods, and providing them with

scratching litter in which to exercise, get a healthy appetite, and strengthen their digestive organs. A keen lookout should be kept for poultry parasites—Tick, Red Mite, and Stickfast Flea—and action taken immediately they are observed, as they multiply so rapidly that once they get a foothold, the cost in time and money increases in proportion.

The natural ambition of poultry breeders to-day is to obtain the greatest number of eggs from their stock, and in the interests of those engaged in the industry, and the progress of the State this ambition should be encouraged; but to aim only at increase in number of eggs irrespective of quality, size, and cost of production, and the deterioration of the fowl, is a foolish policy. The practice with most poultrymen, when they wish to obtain more eggs, is to increase the animal food supplied to the fowls. Most meat meals obtainable in this State contain an excessive amount of dried blood in comparison to the quantity of lean meat. For poultry an excess of concentrated dried bood is an irritant poison, and over-stimulating, and results in ovarian troubles, infertile eggs, bad hatches, and weakly chickens.

The losses of chickens that die before they are six weeks old are enormous. Bad incubation, faulty brooders, and wrong methods of feeding contribute, to a certain extent, toward this heavy mortality, but the main cause is badly reared, over stimulated, underfed, and under exercised breeding stock. If more attention were paid to the stamina and vitality of the breeding stock, and the young stock reared under more natural conditions, and given a chance to develop to maturity before commencing to lay, the lack of fertility, weakly chicks, and small eggs would not be much in evidence. A close study of egg-production makes it apparent that there is much in the system of feeding fowls, under varied conditions, and in different climates, and it does not follow that because a certain balanced ration is giving good results in England, Victoria, or America it will do the same in Western Australia. My own experience has proved to me that green food is a greater factor in the development and retention of vigor in fowls in this State than is realised by most poultrymen, and, used judicially, skim milk or cocoanut oilcake are more safe and give equally good results as meatmeals or other stimulants, with no bad results to the internal organism of the fowl.

As a winter green food for poultry I find that capeweed (which grows abundantly on the loose sandy soils, more especially if the sand has been cultivated) gives spendid results in egg production, and poultry prefer it to lucerne. Berseem Clover, if sown in drills in March and watered until it is established, will yield up to eight cuttings per annum of succulent green food, containing little fibre and high percentage of nitrogenous matter so valuable in the production of eggs and health giving qualities. Berseem should be cut first when only a few inches high in order to induce a better stool, and subsequent stronger growth. Frequent top-dressings of poultry manure during the winter will greatly assist rapid growth. Green stuff should be finely chaffed, and fed as freshly as possible—on no account should it be allowed to ferment. With wheat at 7s. 6d. per bushel, pollard £9 10s., and bran £9 per ton, the cost of feed alone to rear pullets to laying age is approximately 8s. per bird, add to this cost of incubation brooding, losses, and labour, and each pullet will have cost 10s. at six months old. The cost of feed for the following 12 months will be at least 12s. The hen at 18 months old has cost £1. How much has she earned? Suppose the average price of eggs to be 1s. 9d. per dozen for the 12 months' laying, and the hen lays 120 eggs in

the same period, the value of the eggs produced would be 17s. 6d.—2s. 6d. less than total cost of hen's rearing. The only profit made would be the margin between 2s. 6d. and the price realised for her carcase. This shows the necessity for increased production individually, by single testing, and the ultimate raising of the flock average by breeding only from tested layers, reared under the most suitable conditions and fed well, yet economically, on a mixture of foodstuffs which contain sufficient nutrients in the right proportion for the purpose required, viz., egg production.

Better stock, scientific feeding, and labour-saving methods will play the largest part in increasing the production of the individual poultry breeder and the State, and until these items are given more serious consideration we will still hear that "poultry does not pay."

STICKFAST FLEA.

R. A. DUSTING,
Poultry Adviser.

This pest is still greatly in evidence, and according to reports received at this office is spreading to all districts where poultry is being raised. The metropolitan markets are showing a decrease in the number of infested birds marketed. This is mainly owing to producers using preventive methods against the flea and treating any that are infested before sending them to market.

There are several methods of control of the flea. The most successful is to cement the floors of roosting houses and to have temporary shade that can be removed and destroyed. Another method of combating the flea is to remove the roof from all houses early in the summer and allow the sun to have full play on all parts of roosting quarters. If hens are housed in winter they will continue to use the same roosts when the roof is removed.

Yet another way is to have movable houses and move them from eight to 10 feet once weekly, the full sunlight being allowed to strike the position recently occupied by the house.

For spraying purposes to kill the flea and larvæ in the soil, "Dumore" has proved effective owing to its penetrating and lasting qualities.

For the treatment of the birds' heads infested with flea any non-burning oil or grease is all that is necessary to kill the flea that is on the bird, but this will not prevent the birds from again being attacked by fresh fleas, which must be destroyed in the soil.

With any and all of the above methods, cleanliness of the houses and yards must be combined. Droppings should be destroyed by immersion in water with quicklime added for at least 24 hours, when the solution may be used as a liquid manure.

It is only by constant vigilance and the use of preventive methods on the part of poultry breeders that this pest can be controlled.

THE GARDEN.

Seasonal Notes.

H. D. LARWOOD.

APRIL.

Sow—

Cabbage: Succession, East Ham, Drumhead.

Cauliflower: Early Short Stemmed Eclipse, Metropole, Autumn Giant.

Parsnips: Hollow Crown and The Student.

Carrot: Early Horn, Ox Heart, James' Intermediate.

Beetroot: Egyptian Turnip Rooted, Eclipse, Crimson Globe, Long Red Erfurt.

Peas: William Hurst and American Wonder.

Boad Beans: Early Long Pod and Broad Windsor.

Lettuce: New York, Drumhead, Cos, Neapolitan.

Radish: Long Scarlet, White and Scarlet Turnip varieties.

Onions: White Queen, White Barletta, White Italian Tripoli, Brown Spanish, Brown Globe, Giant Rocca.

Leeks: London Flag.

Kohlrabi: Purple and Green Leafed.

Rhubarb: Topp's Winter and Giant Winter varieties.

Transplant—Cabbage, Cauliflower, Onions, Leeks, Kohlrabi, Rhubarb, Celery, Brussels Sprouts, Swede Turnip.

MAY.

Sow seeds of Cabbage, Carrots, Parsnips, Turnips, Lettuce, Beet, Peas, Broad Beans, Radish, Onion, and Tomatoes (Early Large Red variety).

Plant where free from frost—Potatoes: Delaware, Bismarck, Early Rose, and Carmen varieties.

JUNE.

Same as May.

Cultivation during Winter Months.— Keep the soil as open as possible by frequent hoeing and cultivation. Never allow your garden land to become heavy and cloggy. Keep the drains well open and clean, if land has to be drained at all. Keep the land free from weeds. Top dressings of fertilisers during the winter months will materially assist growth. If the land is high and dry water any backward plants with a solution of a large handful of sulphate of ammonia or nitrate of soda to four gallons of water, or the same may be applied dry, depositing the fertiliser sufficiently away from the roots so as to avoid contact with the leaves, a handful to 40 or 50 plants. This application can be made every two or three weeks with safety. Blood and bone manure applied at the rate of one cwt. per square chain will also materially assist growth.

CABBAGE.

H. D. LARWOOD,
Potato Inspector.

This important plant belongs to the Brassica family, and has been so well developed from its wild state that it is now a very popular food item.

Both cabbage and cauliflower need to be transplanted. To raise the plants, select a light friable soil, thoroughly work it up and make into beds about three feet wide and varying in length, according to the number of plants required. When preparing the seed bed, leave the soil with a fine tilth and slightly raise the sides and end of the bed; this will help the bed to retain the moisture when applied. Manure the seed bed with farmyard manure, or a slight sprinkling of blood and bone fertiliser, which should be well hoed in. Smooth the surface with the back of a rake. Sow the seed fairly thickly, and cover with about a quarter of an inch of fine soil. Water the seed bed well during the summer, using a watercan with a fine rose. The seed will germinate in the course of several days, the period varying with the season. The plants are usually ready for transplanting in from four to six weeks. An ounce of seed should give several thousand plants, the number varying according to the size of the seed. As a rule late varieties of cauliflower seed are much larger than the early varieties. Cabbage seed can be sown every month of the year while cauliflowers are essentially a winter plant, and the seed can be sown only from late in December to April.

Cabbage can be grown all the year round on well-drained swamp land. It is of a hardy nature, and is not materially damaged by frost. In fact the texture of Savoy cabbage is improved by frost, giving the heart a tenderness which cannot be obtained without it; this also applies to Pickling or Red Cabbage.

Swamp land, and loamy soil if irrigated during the summer, can be planted at any time of the year. Summer crops are ready for cutting in about 10 weeks, and 12 to 14 weeks in the winter time. Cabbage is successfully grown during the winter months in the sand when liberally treated with manures.

Varieties.—For planting all the year round, "Henderson's Succession" will be found to be one of the best. It is a semi-drumhead variety, and is one of the best varieties of cabbage yet introduced. Care should be taken to cultivate the best strain of seed. This variety was raised by Mr. Peter Henderson, of New York, United States of America, and to make certain of the strain it may be necessary to buy from him direct. Varieties which run "Succession" very close are "Early Drumhead" and "Large White Brunswick." These are both good, especially the latter, for summer planting. Other good varireties which thrive in various localities are "St. John's Day," "Early Surehead," "East Ham," a sugar-loaf variety which does well in sand, and "Winningstadt."

Selection of Soil.—Well-drained swamp land is to be recommended for the general culture of cabbage. For late summer cropping (January and February) swamp land which has been flooded during the winter months and the land planted as the water goes back, or dries up, will be found most suitable.

This land is generally free from pests such as aphis and moth, owing to the flooded nature of the land during the mid-winter months. Chocolate or loamy soils of the South-West can be planted during the winter or spring, if irrigated during the summer months. Plantings are made in the sand during May, June, and early in July.

When to Sow.—For spring crop, the seed will need to be planted during June, July, and August. For summer—September, October, November, December, and January. For autumn and winter—February, March, April, and May.

Manuring.—This is one of the most important points to be observed. Cabbage must not be checked in any way during the growing period. If checked, especially during summer months, cabbage aphis and moth will invariably attack the crop. An abundance of manure must be used. A liberal dressing of farmyard manure as a foundation is usually applied, while to ensure a prolific crop, artificial manure is necessary. A watering of sulphate of ammonia during the summer months is beneficial, using a large handful to four gallons of water, and during the winter a handful dry to about 40 plants. Do not throw the sulphate of ammonia on the leaves, as direct contact will burn the foliage. Cabbage must be forced, especially during the summer months, to withstand the ravages of insect pests and to obtain the desired tenderness of texture to obtain full market rates. Farmyard manure is best broadcasted. Artificial manure is usually placed in a small hole made by the hoe, a small handful to each hole and a double handful of farmyard manure. If the lands or beds are narrow, these holes can be quickly made, and use will so train the eye that no line will be needed. The rows of holes are made from 18 to 24 inches apart, and the same distance in the rows. The manure in the hole is worked up and the plant placed in the centre. Broadcasting is to be recommended, as the plant roots will always have the manure to feed upon; considering the high cost of manure, the hole system is economical and gives good results. If retarded growth is noticed, an application of sulphate of ammonia will revive the plants. If grown on a very large scale, cabbage may be planted while ploughing. The manure can then be put along every second or third furrow, and the plants planted on the top of the furrow. This is an ideal method for winter and spring planting, as the land is left in an untrodden state and well loosened up. The land must be in good order, because after planting it is impossible to harrow the soil. To be successful, the land must be ploughed two or three times and harrowed thoroughly, previous to the last ploughing or planting. This method can also be applied to cauliflower planting during autumn.

Cultivation of Soil.—The land requires to be thoroughly prepared either by ploughing or digging. If the area of the land or beds is large, plant wide enough to use a horse cultivator, and be sure to hoe between the plants where the cultivator cannot reach, in order to loosen the soil. Weeds must be kept down. Do not let weeds seed, or the result will be a verification of the old saying, "One year's seeding, seven years' weeding."

Irrigation.—Sufficient moisture must be available either in the soil naturally or applied. The land must not be over-watered during the summer, otherwise there will be stoppage of growth, caused by the water-logged conditions. The great danger of applying water to plants is "overdoing it." Overhead

sprinkling lends itself very favourably to the cultivation of cauliflower and cabbage during the summer months. The sprinkling minimises the danger of aphis and insect pests. It is surprising the amount of moisture plants will absorb during the summer. Watering, especially by use of ditches, is often overdone.

Marketing.—Cabbage requires to be solid before marketing. Do not cut before the heads are well matured and heavy. While cabbage is usually sold by the bag (chaff bags being used), the value is often tested by the weight of the contents. For the inland and North-West trade, cabbage must be solid. When gathering for market, cut several leaves below the heart, leaving it well protected by at least one or two leaves all round. When bagging, fold these protecting leaves over the heart, but do not sew the mouth of the bag up. Pack the cabbages well up to the top of the bag so that it is necessary to form a net-work of string over the top of it.

CAULIFLOWERS.

Seed Beds.—The seed beds for these are prepared and sown in the same manner as for cabbage.

The Soil.—The selection of the soil is an important factor. It is erroneous to think that where cabbage will grow, cauliflower will grow; this is not so. The peaty swamps of our coastal area, while ideal for cabbage, are not so favourable for cauliflower. While there are a few favoured spots on the borders of some of our metropolitan swamps, *i.e.,* which chiefly consist of a sandy loam, the majority of cauliflower supplies for the markets are grown on the heavier soils towards the hills. Cauliflowers thrive on a good loamy chocolate soil. They are also grown with advantage on sandy clay soils. Land which is comparatively free from frosts will be found to be the most suitable. The plant itself is very little checked by frost, but if the heart is exposed to frost it will lose its whiteness and turn a dirty yellow colour. If the land is subject to frost, plant only the self-protecting varieties, the hearts of which are well protected by the inner leaves.

Varieties.—For early planting: "Early Erfurt," "Early Snowball," "White Queen," "Early Eclipse," and "Early Short Stemmed Eclipse."

For main crop: "Short Stemmed Eclipse," "Veitche's Autumn Giant," "Short Stemmed Giant," and "Giant of Naples."

For late crop: "Metropole," "Large Asiatic," and "Walcherin."

Plant seed for early varieties during December and January. Varieties for main crop in February and March, and varieties for late crop in March and April. The careful selection of seed is necessary. Procure seed from reliable sources. Cheap seed is often poor seed. Early cauliflowers will take from 10 weeks after transplanting; main crop from 13 weeks, and late varieties from four to six months to mature.

Fertilising.—The manuring of cauliflowers is the same as for cabbage, but if anything, the cauliflower needs more, both farmyard and artificial. With cauliflowers, an occasional application of sulphate of ammonia, say a handful to about forty plants during the latter part of the growing period, will materially assist in the development of the plants. A beautiful green colour will be obtained in the leaves and the formation of much superior flower will be the result. Market gardeners usually apply their top dressing every two or three weeks during the later stages of the growing period.

Transplanting.—When lifting the plants for transplanting, keep the air from the young rootlets as much as possible. This can be done by using a small fork, and placing plants directly into a box or vessel and transfering immediately to the permanent bed.

Cultivation.—Cauliflowers need more growing room than cabbages: the usual distance apart for the early varieties being 30 inches and the main and late crops three feet each way both between and in the rows. Constant hoeing of the soil is beneficial. While the production of prime cauliflowers is perhaps the severest test for any gardener, their cultivation almost solely depends on three points—suitable soil, select seed, and abundance of available plant food.

Irrigation.—Irrigation of cauliflowers is precisely the same as for cabbage.

Marketing.—Do not become weary waiting for the heart or flower to form; it will be sure to come in due time, usually during the last week or two. Wait till the flower has properly developed and fully filled the cup, which nature has formed for it, before cutting; do not, however, let the flower begin to run to a point resembling a pin head before cutting. A flower of good size, the larger the better, with a fine close compact texture, is what is required for market, and satisfactory values for these are invariably maintained. Cut the plant several leaves below the flower or about the second leaf from the bottom. If too far from market to cart in, put in bags, placing the whole of the cauliflower after it has been cut crosswise in the bags, and on no account whatever trim off the leaves above the heart and pack like cabbages, because the hearts will become bruised and discoloured. Pack with as many leaves as possible adhering to the heart.

Brocoli.—This is a very useful type of the cauliflower family, and will do where the winter is severe and cauliflowers cannot be grown. Plant same as in the case of cauliflowers.

Useful Hints.—Good soil, abundance of plant food by way of manure, forcing with ammonia, carefully selected seed, and careful irrigation should recompense the producer with prime market products. Keep the plants growing profusely, and attacks from pests will be minimised.

CULTIVATION OF THE POTATO.

G. N. LOWE,
Senior Potato Inspector.

It is the greatest possible mistake to allow the soil to become "tired" or exhausted. Correct fertilising, together with intelligent rotation of crops, will prevent this, and at the same time do much toward keeping in check diseases to which the potato is subject, and which flourish to the maximum when potatoes are planted season after season in the same paddock.

So often is the statement made that for the first few seasons a certain piece of land returned profitable crops, and then the yield began to dwindle, and various diseases became more and more apparent. The explanation is not far to seek, inasmuch as the soil has been unfairly treated in the matter of continuous cropping with potatoes and no effort has been made to build it up, even to its original fertility.

The maxim "A change is as good as a rest" can very truly be applied to the treatment of soils, and it is hardly fair to blame a soil for want of productiveness because of lack of commonsense treatment in the matter of rotation.

Soil is a mixture of inorganic material, such as rocks and other mineral substances, which by the action of sun, light, air, and weather has become broken down into finer particles, together with decayed or decaying vegetable or animal matter, this portion being, of course, organic.

The inorganic part, which greatly predominates, supplies the mineral needs of the plant, whilst the organic supplies the nitrogen, a very necessary element to the plant's wellbeing.

It is readily seen then that if the original materials are lacking or have become depleted through constant cropping, in order to restore this exhausted soil to a proper fertile condition steps must be taken to ensure a sufficient quantity of organic material being returned to the soil.

A proper rotation of, say, oats, peas or subterranean clover and potatoes will have the effect of accomplishing much in this direction. Instances of splendid results can be quoted where growers have been prevailed upon to plough in portions of their older subterranean clover plots at planting time. A wealth of green stuff of a nitrogen fixing plant, such as subterranean clover, cannot fail to restore a worn out soil quickly, particularly when its nitrogen content has become depleted.

Green manures affect the soil in a variety of ways, some of them being:—

(1) The addition of humus.

(2) The increasing of nitrogen, where a leguminous crop is used.

(3) The making available of plant food which might otherwise be lost.

The kind of green manure to be used depends, of course, upon the effect desired. If humus alone is needed then the bulkiest green crop that can be ploughed in will be best, provided this operation is carried out when the plants are at their most succulent and juicy stage, as decomposition takes place then more easily and more quickly.

If, however, nitrogen is required, as is always the case with potatoes, then one of the legume family, such as peas, clovers, etc., must be used. The

function of nitrogen is to stimulate a luxuriant tender growth, with tubers richer in nitrogen, but at the same time more prone to disease. To this fact and to the lack of potash in the potato fertiliser, more generally used, may be ascribed the poor keeping qualities of tubers from some of our older potato-growing areas. A deficiency in regard to nitrogen is shown by a weak yellow growth.

The elements of plant food in the soil are transformed or manufactured in the leaves in combination with sunlight and air gasses, and from the edible tubers. So that these processes may be performed to their maximum, it follows that the factory, that is the plant itself, must be strong and healthy.

The demand by the plant for nitrogen is stated to be particularly apparent during the earlier portion of its growth.

Phosphoric acid hastens the maturing of the plant, and is also supposed to help in starch production. There is a great deal of doubt, however, whether in this State growers are not using far too great a weight of superphosphate (the source of phosphoric acid) per acre in order to give the crop sufficient nitrogen, the mixtures used being probably too low in that particular content.

With this object in view a series of experiments designed to test the theory are in hand, the first of which is now planted in Benger Swamp.

The draft of the trials is printed below, and shows the variations of nitrogen and phosphoric acid. Potash is a constant factor except in the plot planted with No. 2 Potato Manure.

POTATO FERTILISING EXPERIMENTS AT BENGER—SUMMER CROP, 1925.

Plot.	Lbs. plant food per acre.	Manuring per acre.	Manuring per plot 1/25 acre.
Plot I. Control	N. 100lbs. ... P_2O_5 300lbs. ... K_2O 100lbs. ...	500lbs. Sulphate of Ammonia 1,429lbs. Super. ... ... 204lbs. Sulphate of Potash ...	20lbs. Sulphate of Ammonia. 57lbs. Super. 8lbs. Sulphate of Potash.
Plot II. ...	N. 72lbs. ... P_2O_5 300lbs. ...	2,400lbs. Potato Manure ...	96lbs. Potato Manure.
Plot III. ...	N. 70lbs. ... P_2O_5 300lbs. ... K_2O 100lbs. ...	350lbs. Sulphate of Ammonia... 1,429lbs. Super. ... ... 204lbs. Sulphate of Potash ...	14lbs. Sulphate of Ammonia. 57lbs. Super. 8lbs. Sulphate of Potash.
Plot IV. ...	N. 40lbs. ... P_2O_5 300lbs. ... K_2O 100lbs. ...	200lbs. Sulphate of Ammonia... 1,429lbs. Super. ... ... 204lbs. Sulphate of Potash ...	8lbs. Sulphate of Ammonia. 57lbs. Super. 8lbs. Sulphate of Potash.
Plot V. ... Control	N. 100lbs. ... P_2O_5 300lbs. ... K_2O 100lbs. ...	500lbs. Sulphate of Ammonia... 1,429lbs. Super ... ... 204lbs. Sulphate of Potash ...	20lbs. Sulphate of Ammonia. 57lbs. Super. 8lbs. Sulphate of Potash.
Plot VI. ...	N. 100lbs. ... P_2O_5 200lbs. ... K_2O 100lbs. ...	500lbs. Sulphate of Ammonia ... 952lbs. Super. ... ... 204lbs. Sulphate of Potash ...	20lbs. Sulphate of Ammonia. 38lbs. Super. 8lbs. Sulphate of Potash.
Plot VII....	N. 100lbs. ... P_2O_5 100lbs. ... K_2O 100lbs. ...	500lbs. Sulphate of Ammonia ... 476lbs. Super. ... ... 204lbs. Sulphate of Potash ...	20lbs. Sulphate of Ammonia. 19lbs. Super. 8lbs. Sulphate of Potash.
Plot VIII.	N. 100lbs. ... P_2O_5 300lbs. ... K_2O 100lbs. ...	645lbs. Sodium Nitrate ... 1,429lbs. Super ... ... 204lbs. Sulphate of Potash ...	20lbs. Sodium Nitrate. 57lbs. Super. 8lbs. Sulphate of Potash.
Plot IX. ... Control	N. 100lbs. ... P_2O_5 300lbs. ... K_2O 100lbs. ...	500lbs. Sulphate of Ammonia ... 1,429lbs. Super ... ... 204lbs. Sulphate of Potash ...	20lbs. Sulphate of Ammonia. 57lbs. Super. 8lbs. Sulphate of Potash.

One row of 10 chains long = 1/25th acre.

NOTE.—It was hoped to include a plot with blood as to source of organic nitrogen, but as material was unobtainable the plot had to be excluded.

HORTICULTURAL NOTES.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

SEASONABLE WORK FOR APRIL, MAY, AND JUNE.

APRIL.

I wrote the Horticultural Notes for the December issue of the *Journal* in November before a reliable estimate of the season's fruit crop could be made, and at that time the profusion of blossoms and healthy appearance of the trees gave rise to anticipations of a record crop. Climatic conditions, however, alternating from warm and mild to rigorous and wintry, particularly in late spring, prevented many kinds and varieties of fruits from setting the bumper crop which was expected. But though the crop is not heavy, it is a very long way from being a failure, and during the months of March, April, and May a goodly number of steamers will call at the Ports of Fremantle, Albany, and Bunbury for the purpose of loading fruit for England, and the growers of kinds suitable for export will, in the first two months named, have their time fully occupied in picking, grading, and packing, both for export and local markets. Sufficient space has been booked for 237,000 cases to be sent to England from 2nd March to 18th May, and the indications at present point to this quantity being exceeded. Apples will comprise the major portion of our shipments, but there will also be a fair quantity of pears and grapes.

Western Australian apples, from the time of the first shipments, about 20 years ago, have carried an excellent name for quality and appearance on the European markets, and I think, with the exception of last year, growers have generally lived up to this reputation. Last season, however, it must be admitted the fruit forwarded was not of the usual high standard of quality: in the first place the season was against it, dry weather commencing in October, and continuing until May, and in the second, the packers were not thorough enough in rejecting, for when a considerable proportion of the fruit on the packing bench is inferior, the tendency is to become slack in grading.

This year we have a splendid chance of wiping out any bad impression that may have been created last year, for our apples have never been of better quality, and if reasonable care is exercised in rejecting large sized and blemished fruits, there should be no complaints from buyers, and the apples in the red cases will do in London this year what they have so often done before—top all competitors' returns by shillings a case.

I have mentioned apples particularly in the above, but no matter whether the fruit exported comprises apples, pears, grapes, or any other fruit a high standard of excellence should be striven for, because it does not pay to incur expense for rail freight, boat freight, and shipping charges on poor grade fruit.

Apply fertilisers to the orchards during April, and where trees are bearing well, do not be afraid of overdoing it. A reasonable dressing on average orchard soil for trees in full bearing is six cwt. superphosphate, two cwt.

muriate of potash per acre, with one and a-half bushels of peas sown in April and ploughed under in Spring.

The land should be thoroughly prepared this month where new orchards are to be planted. Plough to a depth of 10in. or 12in., and remove all roots of native trees.

Baiting for fruit fly should be continued, and every care taken to destroy all infested fruits.

Spray orange and lemon trees towards the end of this month with Bordeaux or Burgundy mixture to control Brown Rot, using 4lbs. bluestone, 4lbs. freshly burned lime, 50 gallons water or 4lbs. bluestone, 6lbs. washing soda, 50 gallons of water. The ground under the trees should also receive a liberal spraying with Bordeaux or Burgundy. When the disease is scattered throughout the orchard it is not wise to confine the spray to infected trees only: in the case mentioned all trees should be treated alike. Observations to date tend to show that the trees which have been sprayed to a height of 4ft. to 5ft. from the ground are as free from Brown Rot as those which have been sprayed all over.

MAY.

Apple growers will finish harvesting their crops this month, and the export season, so far as the English market for apples is concerned, will be over before the 31st.

Pruning will claim the attention of growers of stone fruits, particularly in the early districts near Perth, where most varieties of apricots, plums, and peaches will have shed their foliage. Where varieties of peaches liable to shed their buds (Briggs, Hales, Downing, Alexander, etc.) are grown, it is advisable to delay pruning until the buds have burst in early Spring.

Spray deciduous orchards for the control of San Jose, as soon as the leaves have fallen, using commercial lime sulphur at a strength of one gallon in 10 gallons of water, or a reliable brand of spraying oil may be substituted for lime sulphur. To keep San Josè Scale in check it is necessary to spray twice while the trees are dormant: the first to be applied as early as possible after the leaves have fallen, and the second towards the end of winter. As August is often a very wet month care should be exercised in making the May spraying a very thorough one.

If apple treees are infested with both San Josè Scale and Woolly Aphis, the best winter spray to use is lime sulphur, one in 10 to which has been added two ounces of Black Leaf 40 for every 10 gallons of lime sulphur mixture.

If the weather remains fine continue baiting trees for fruit fly.

Where orange and lemon trees were not treated for Brown Rot last month, they should be sprayed during the early part of this month, using Bordeaux or Burgundy as advised in April notes. In tests made both by this Department and individual growers it has been shown that one spraying in April or early May is sometimes sufficient to control the disease for the remainder of the season, but should the season prove favourable for the fungus, the trees should receive a further spraying when signs of infection appear. Later sprayings have the effect of spotting the fruit, but it is better to remove spray spots from sound fruits at time of picking than to have the crop destroyed by disease. In recommending spraying I am not over-

looking the fact that there are some districts where the disease has not appeared, or at any rate, has not been noticeable, and in such places I would not suggest spraying merely as a preventive measure, but should it make its appearance spraying should be resorted to at once.

JUNE.

Pruning of all deciduous trees should be pushed on with during this month.

Planting may be undertaken wherever the soil is not too wet and sticky.

Young plants when received from the nursery should be heeled in carefully so as to prevent the roots from drying out. To do this effectively the bundles of ten, in which the nurserymen usually tie up the trees, should be opened and each tree placed separately in the soil. If this is done as soon as the trees arrive no harm will result if the planting has to be postponed for some weeks in the months of June or July.

The notes on planting for this month refer to deciduous trees only. Citrus trees give best results if planted at the latter end of August or early in September.

Any San Josè Scale infested orchards which have not received the first spraying mentioned in notes for May should be treated as early as possible this month.

Citrus growers should examine cracked oranges for signs of fruit fly, and destroy any found to be infested.

Orange export season commences this month, and as far as possible growers should gather the fruit when it is dry, and take every care in handling and packing to see that the fruit is not bruised nor the skins scratched with finger nails. Hundreds of cases of oranges which were sent forward for shipment last year were refused a permit on account of being in a wasty condition, and though wet weather at time of picking may have been responsible in some degree, rough handling was a contributory cause, and while the first was in a large measure unavoidable, the second was preventable.

NEW POTATO REGULATIONS.

The Minister for Agriculture (Hon. M. F. Troy) draws the attention of growers, potato merchants, vegetable salesmen, and others handling potatoes, to a regulation governing the distribution of potatoes within the State. This regulation which was put into force at the request of the potato growers, was gazetted on 7th November. It prohibits potatoes being conveyed either by road or rail, into an area extending from Rockingham to Mundijong, thence to the southernmost corner of Collie townsite, through Dinninup to Tingerup (on the Great Southern Railway) and to the sea-coast at Cape Riche, and following the coast back to the starting point. The Minister states that numerous breaches of this regulation have occurred, probably through ignorance, and he desires to warn those interested that prosecutions will be instituted if the regulation is further infringed.

BLASTOPHAGA FIG WASP.

(*Blastophaga grossorum.*)

L. J. NEWMAN, F.E.S.,
Entomologist.

CAPRIFICATION EXPERIMENT.

This beneficial wasp has been introduced and established for the purpose of fertilising the Smyrna figs which, without its agency, fail to mature their fruit. This has been successfully accomplished.

To test the further usefulness of this wasp when applied to the Mediterranean and Adriatic types commonly grown, an interesting experiment was made in 1920 with the White Adriatic and Adam figs, and again in December, 1924, with the Brown Turkey variety.

It may not be generally known that there are two distinct types of figs grown locally, namely, those which ripen an edible fruit without developing perfect or fertile seeds, or, in other words, those varieties which become pomologically but not botanically ripe. To this class belong all the edible varieties of figs grown in the State, with the exception of the Smyrna types. These varieties, owing to the absence of fertilisation and consequent lack of seed, can only be propagated by means of cuttings, suckers, or grafts. The second group contains those which are unable to ripen or become fit for eating except the formation of seeds takes place, when they become both pomologically and botanically ripe. To this class belongs the famous drying varieties, known as the Smyrna figs. These fruits produce fertile seeds which readily grow when planted. To accomplish this fertilisation caprification is essential. This is accomplished by the transference of the pollen from the wild Capri fig to the flowers of the Smyrna.

Unlike the flowers of most fruits those of the fig are developed within the fruit, and cannot be visited by ordinary passing insects, which generally act as pollen carriers, or it may be wind distributed.

In the case of the fig, nature has provided a highly specialised wasp for the cross-pollination of its flowers. This is a tiny chalcid wasp. The male is wingless, but the female is furnished with wings and is capable of flight. In general appearance the female is not unlike a small black-winged ant.

This tiny pollinising agent is developed within the Capri fig. This fig contains what are termed gall flowers and male flowers. It is a wild variety and useless for any other purpose than as a host medium for the propagation of this insect. The female making her way out of the Capri fruit has to push through a mass of male flowers which are situated at the top of the fig surrounding the orifice or opening. In passing through these flowers she becomes covered with the pollen grains.

When the wasp escapes from her host fruit she immediately flies away in search of a new Capri fig, in which to lay her eggs. The eggs are laid into the gall flowers found within this fruit. These eggs give rise to tiny legless maggots, which go through the whole of their larval and pupal stage within the gall flower, emerging in the manner previously described.

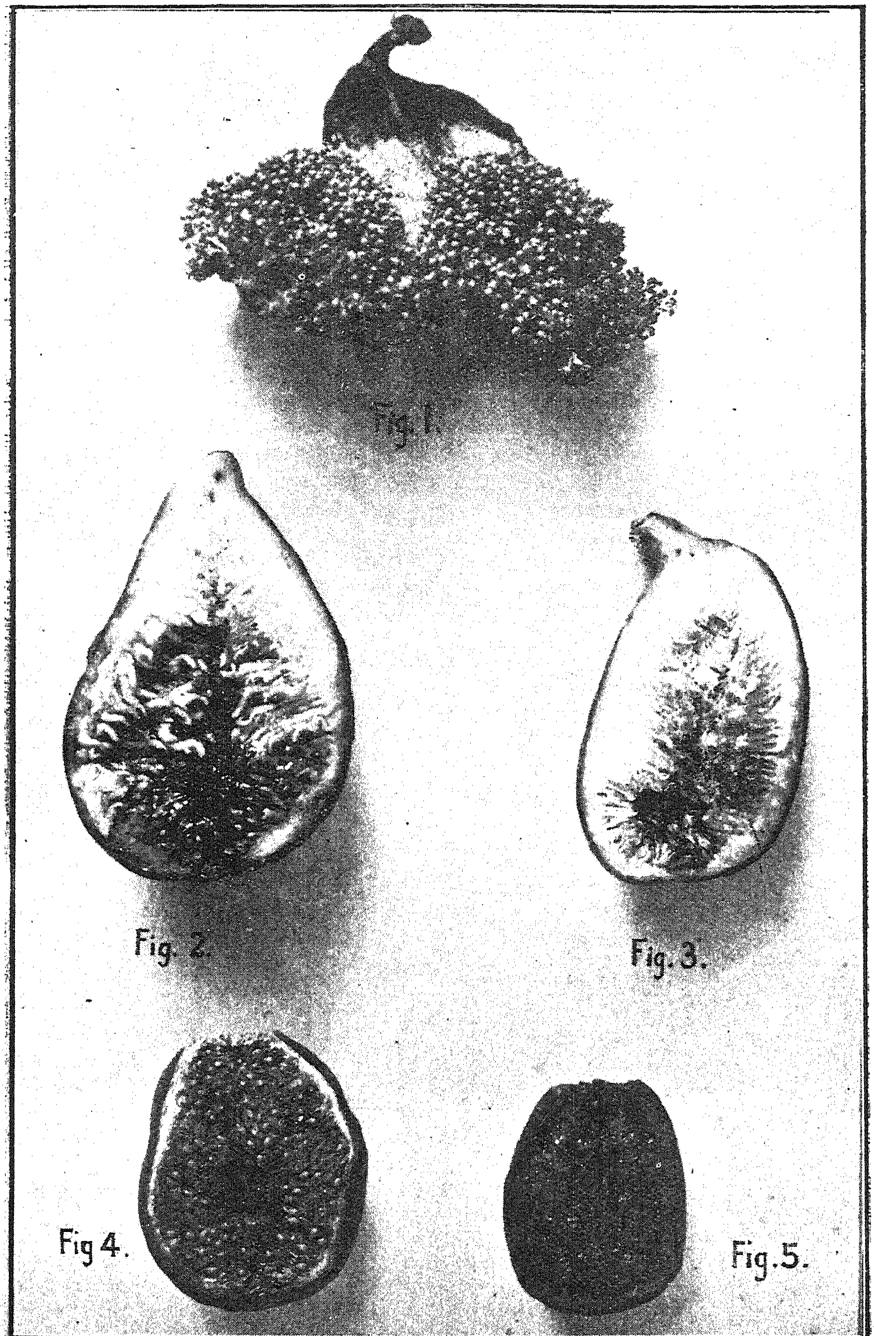


Fig. 1.—Capri fig opened showing the mass of gall flowers from which the wasps issued and the clusters of male pollen-bearing flowers.
Fig. 2.—Brown Turkey Fig caprified. Note development of seeds, flesh, and size.
Fig. 3.—Brown Turkey Fig uncaprified.
Fig. 4.—Brown Turkey Fig caprified. Observe seed formation.
Fig. 5.—Brown Turkey Fig uncaprified. Note absence of seeds.

If it happens that this wasp enters a Smyrna fruit fertilisation is accomplished, resulting from the shedding of the pollen grains carried on the legs and body of the wasp from the Capri to the Smyrna. It is only by this process that we can produce the popular Smyrna fruits. The trees will grow readily, but without the introduction of the wasp they are barren, the fruit falling off when about half grown.

Following the tests previously made in 1920, a further experiment was made during the present summer by applying this wasp to the Brown Turkey variety, which produces an edible fig, but is infertile. The results of the experiment were remarkable, the following effects being noted:—

1. The caprified fruits were observed within a fortnight to turn a dark green, and the skin to become very turgid compared with the non-caprified.

2. The flesh changed colour from a light brown to a decided reddish, rendering the fruit flesh unrecognisable as a Brown Turkey.

3. The fruits were densely packed with perfect seeds, giving a firm feeling when being cut.

4. The weight and size of the fruit was much increased.

5. The flavour was altered in that, plus the sugar, they had the popular "nutty" flavour due to the presence of true seeds.

6. The skin when ripe was of a distinctly bluish tinge instead of brown.

7. The caprification appeared to stimulate the fruits so that they grew out of the effects of the trouble known as the "Fig Leaf Mottle," which causes many of the fruits to shrivel and fall.

8. The caprified fruits were two to three weeks later in ripening.

In the 1920 experiments the findings were similar to those of the present.

Seed germination tests were then carried out, giving in each instance 100 per cent.

It has been demonstrated that the introduction of the wasp to any variety of figs which we grow is beneficial. It improves the size, quality and flavour, and is therefore worthy of trial on a larger scale.

WELL-VENTILATED HOUSES.

It is essential that the poultry house be made draught-proof, if it is not already so, but care should be taken to keep an abundance of pure air in circulation. The laying quarters should always be comfortable, if possible, but warmth at the expense of dryness is never wise. Restricted ventilation is almost certain to be accompanied by dampness, particularly if the house is a trifle overcrowded. Dampness in the hen-house is an invitation to colds and roup.—"Australian Farming."

FRUIT FLY BAIT.

Warning.

L. J. NEWMAN, Entomologist.

It has come to the knowledge of the Department that some fruitgrowers have been substituting the dry or powdered form of arsenate of lead for the paste, and making the mistake of using the same weight of the dry, thus rendering the bait double strength. This is a serious error, as they have not only wasted material, but they have rendered the bait useless by the fact that it is too strong in poison content.

In common practice it is recognised that powdered arsenate of lead is twice as strong as the paste form. In the formula recommended by the Department, 5 ounces of paste arsenate of lead is used to every 4 gallons of the complete bait. It follows, therefore, that on the basis of the powdered form being twice as strong as the paste, 2½ ounces is sufficient to every 4 gallons. It is better to use under the formula strength than over.

In the experimental work undertaken when arriving at a suitable bait for the fruit fly, it was found that as low as 3 ounces of paste or 1½ ounces of dry arsenate of lead to 4 gallons of bait would kill the flies, but was much slower in its effects than when 5 ounces of paste or 2½ ounces of dry was used.

The fault in using the overdose of poison is not that the fruit fly will refuse to take it, but is due to the fact that she does not retain same. After partaking of the over-poisoned bait she quickly regurgitates it, or in other words it acts as an emetic. This was found to be consistently the case when more than 5 ounces of paste arsenate of lead was used in four gallons of bait.

The correct formula recommended by the Agricultural Department is as follows:—

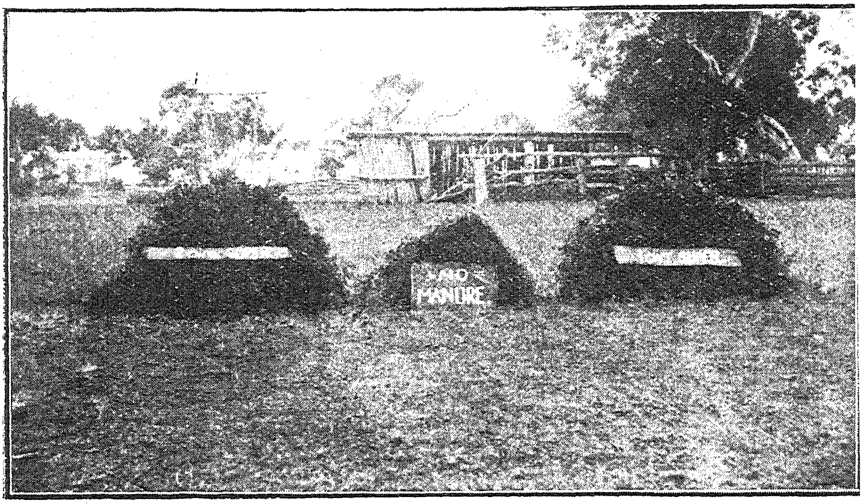
For Foliage Baiting—

Paste arsenate of lead—5 ounces, or
Powdered arsenate of lead—2½ ounces.
Molasses—4 pounds.
Fruit syrup (orange juice preferred)—1 gallon.
Water to make up to four gallons.

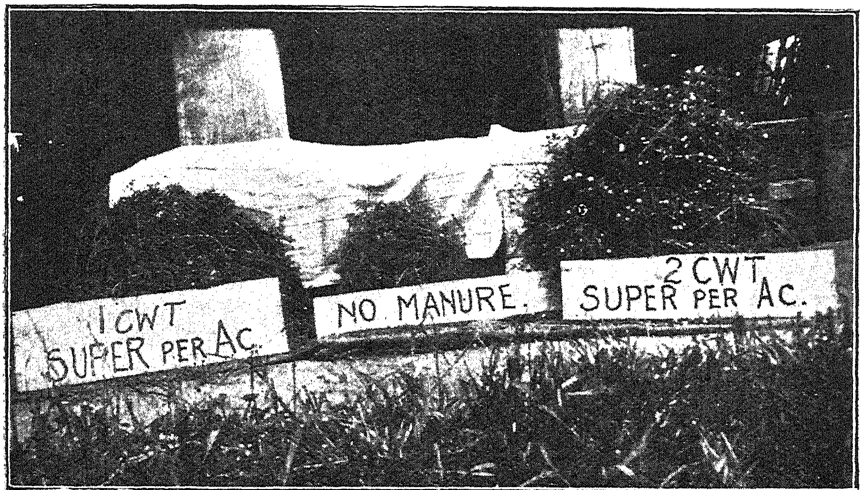
For Traps only—

Pollard—4 pounds.
Molasses—4 ounces.
Paste arsenate of lead—5 ounces, or
Powdered arsenate of lead—2½ ounces.
Powdered borax—8 ounces.
Water to make up to four gallons.

For fuller particulars apply to Department for *Bulletin* No. 122, Fruit Fly, Description and Control.



Result of top-dressing demonstration, Mr. W. G. Argent's Farm, Dwarda, 1924.



Result of top-dressing demonstration, Mr. G. F. Parson's Farm, Narrogin, 1924.

PASTURES.

Top-dressing in Western Australia.

G. K. BARON-HAY, B.Sc., Agric.,
Agricultural Adviser, Dairy Branch.

The necessity of a phosphatic manure for successful crop production is now a recognised fact among West Australian farmers, but it was not until quite recently that the same necessity has been recognised for pasture.

In order to demonstrate the value of top-dressing pastures, experiments were inaugurated in 1922, the aim of which was two-fold—

1. To demonstrate definitely the value of top-dressing.
2. To endeavour to find the most economical manure to apply.

Since 1905 top-dressing has been practised by a few thoughtful farmers in this State, the first demonstrations on record being carried out by Mr. Chales Harper at Guildford, followed by Mr. R. A. Richardson at Serpentine. Excellent results were also obtained at Ferndale in 1908 by Messrs. Harper and Catton-Grasby, but these results, though advertised at the time, were not sufficient to make the practice general.

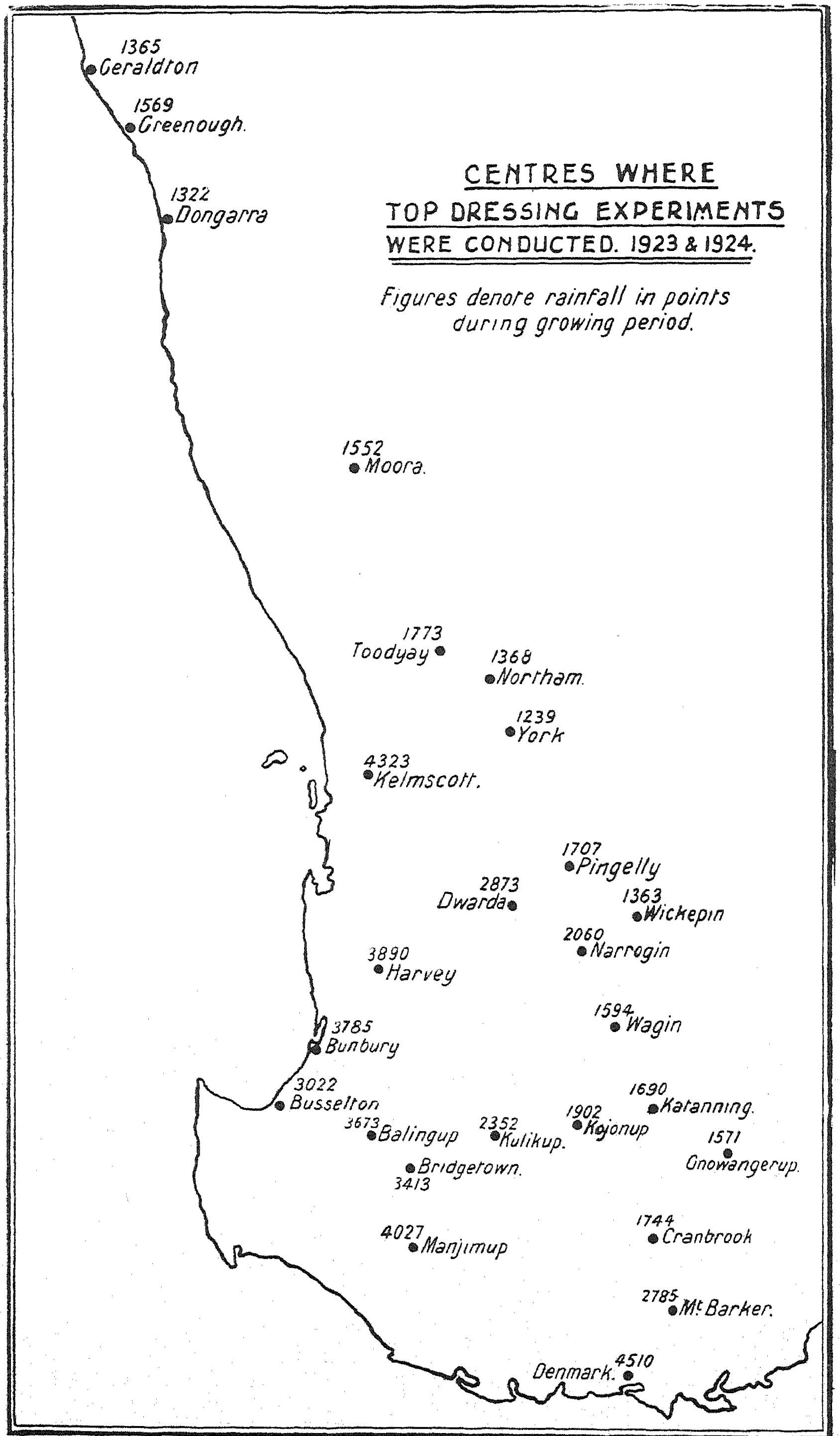
It was found necessary, in order to induce the practice to become State-wide, to carry out demonstrations in each district and on all types of soil. Superphosphate was chosen as the phosphatic manure to use in these demonstrations, for several reasons, the chief being—

1. Easily obtainable.
2. Supplies phosphoric acid more cheaply per unit than any other phosphatic manure.
3. The phosphate supplied is in a form readily soluble in water, and therefore easily available to plants.

At the request of Messrs. Cumming, Smith & Co., Limited, and the Mount Lyell Chemical Works, the Department of Agriculture undertook to co-operate in the carrying out of top-dressing demonstrations throughout the State, the above firms generously offering to supply the necessary superphosphate and signboards. Working through the Royal Agricultural Society, district agricultural societies were asked to recommend suitable sites for the demonstrations, and to supervise the plots during their growth. Such co-operation is of mutual benefit, providing data which is urgently needed, and which are available for any farmers who care to make use of them.

For each demonstration five acres of land were required, choosing, as far as possible, an average piece of land for the district. In some cases, however, distinctly poorer land than the average was selected at the request of local farmers who were desirous of finding out the effect of top-dressing on that particular type. The site, wherever possible, was chosen along a main road, and placed so that all the plots were plainly visible from the road. Suitable notices were erected, showing the treatment each plot had received.

An endeavour was made to sow all manures as soon after the first rains as possible, using a drill for sowing. In some cases, no drill being available,


CENTRES WHERE
TOP DRESSING EXPERIMENTS
WERE CONDUCTED. 1923 & 1924.
Figures denote rainfall in points during growing period.
1365 Geraldton
1569 Greenough.
1322 Dongarra
1552 Moora.
1773 Toodyay
1368 Northam.
1239 York
4323 Kelmscott.
1707 Pingelly
2873 Dwarda
1363 Wickepin
2060 Narrogin
3890 Harvey
1594 Wagin
3785 Bunbury
3022 Busselton
1690 Katanning.
3673 Balingup
2352 Kulikup.
1902 Kojonup
1571 Gnowangerup.
Bridgetown. 3413
1744 Cranbrook
4027 Manjimup
2785 Mt Barker.
Denmark. 4510

the manure was broadcast, and apparently results are as good when sown by hand as with the drill, though not so uniform.

Farmers, on whose land a demonstration was planned, were expected to keep all stock off the plots from the time of sowing the manure until the plots had been inspected by an officer of the Department and the herbage cut for comparative results.

The five-acre area chosen was divided into three plots:—

No. 1. Two acres, top-dressed with 1cwt. superphosphate per acre.

No. 2. One acre, no manure (the centre plot).

No. 3. Two acres, top-dressed with 2cwt. superphosphate per acre.

The accompanying map of the South-West agricultural area of the State shows districts where such demonstrations were carried out.

In order to obtain comparative results of the plots, the herbage was cut from an equal area on each plot and weighed. The gramineous and leguminous portions of the samples were then carefully separated and weighed individually, so as to gain figures throwing light on the *quality of herbage* on the top-dressed plots.

Thirteen demonstrations were carried out during the season 1922-23, and 25 during the season 1923-24. Some of the sites chosen in 1923 were retained for further demonstrations in 1924.

Unfortunately, in several cases, wandering stock gained access to the plots, causing damage sufficient to render the taking of fair samples impossible.

The following table gives the locations of the demonstration plots, the kind of soil, and the average rainfall for that district:—

Name of Farmer.	District.	Soil and Indigenous Timber.	Average Annual Rainfall.
			points.
J. C. Phillips ...	Toodyay ...	Black clay flat to red clay loam ...	2,126
H. Brockway ...	York	Heavy red clayey loam 6in. deep, coarse cement subsoil	1,767
W. O. Sewell ...	Pingelly ...	Brown loam; Jam; good ...	1,705
Austin Piesse ...	Wagin ...	Poor, typical, White Gum and Sheoak country	1,745
Hon. Edwin Rose, M.L.C.	Bunbury ...	Alluvial flat; flooded in winter ...	3,653
P. D. Ferguson...	Barberton ...	Heavy loam	1,861
W. G. Argent ...	Dwarda ...	Chocolate loam, Red Gum and Blue Gum	2,465
W. Gillett ...	Northam ...	Heavy grey clay (sets hard) ...	1,703
G. F. Parsons ...	Narrogin ...	Heavy clayey loam	1,976
H. V. Piesse ...	Katanning ...	Heavy clayey soil; drainage unsatisfactory	1,839
Roy Hayward ...	Harvey ...	Brown loam; Jarrah and Red Gum	3,975
F. Herbert ...	Dongarra ...	Deep dark grey loam; good ...	1,918
A. Clinch ...	Greenough ...	Heavy clayey loam	1,961
Marwick Bros. ...	York	Heavy red loam; York Gum ...	1,767

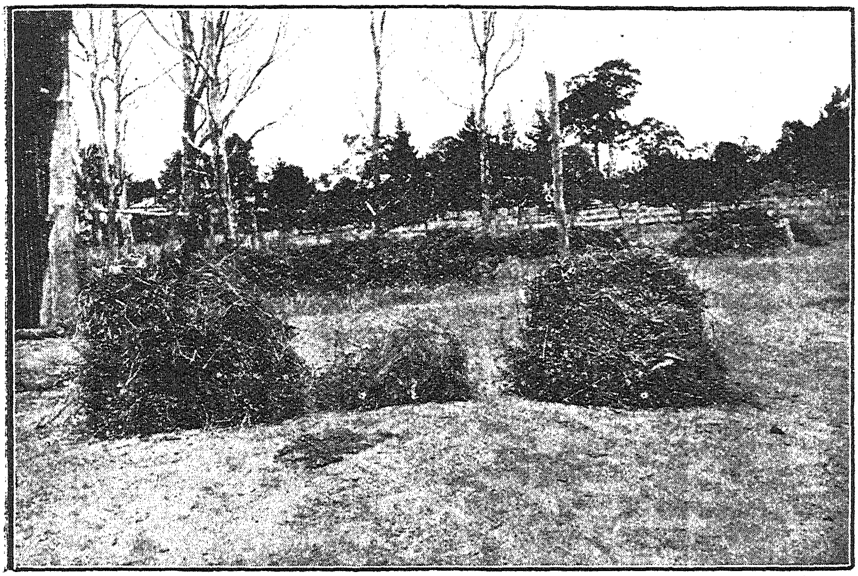
Name of Farmer.	District.	Soil and Indigenous Timber.	Average Annual Rainfall.
			points
Late W. M. Baker	Katanning ...	Red clayey loam, rather gravelly ...	1,839
H. Joiner ...	Wickepin ...	Very poor, white gritty clay; White Gum	1,649
G. Perkins ...	Kojonup ...	Poor sandy loam; White Gum ...	2,231
Butter Factory	Gnowangerup...	Brown clayey soil; uncultivated...	1,826
Sounness Bros ...	Mt. Barker ...	Poor white sand; Jarrah and Red Gum	2,943
W. Middleton ...	Denmark ...	Sandy loam; Jarrah, few Red Gum	4,936
H. Trailmarsh ...	Kelmscott ...	Red loam to rich river flat	4,302
Johnson Bros. ...	Bunbury ...	Alluvial loam; Flooded Gum ...	3,653
E. Trigwell ...	Busselton ...	Calcareous sand, quickly dries ...	3,177
Captain Bell ...	Balingup ...	Poor gravelly light loam; Jarrah and Red Gum	3,936
Donald Palmer	Bridgetown ...	Red gravelly loam; Red Gum ...	3,398
F. Davis ...	Manjimup ...	Good chocolate loam; Red Gum and Blackbutt	4,364
C. J. Tuckey ...	Kulikup ...	Gravelly loam	2,572
G. E. Sewell ...	Geraldton ...	Heavy clay flat, wet in winter ...	1,875

From a perusal of the above list, it will be noticed that almost all types of soil have been treated, from poor sandy soils to rich alluvial flats, also that the annual rainfall varies from 16.49 inches to 49.36 inches.

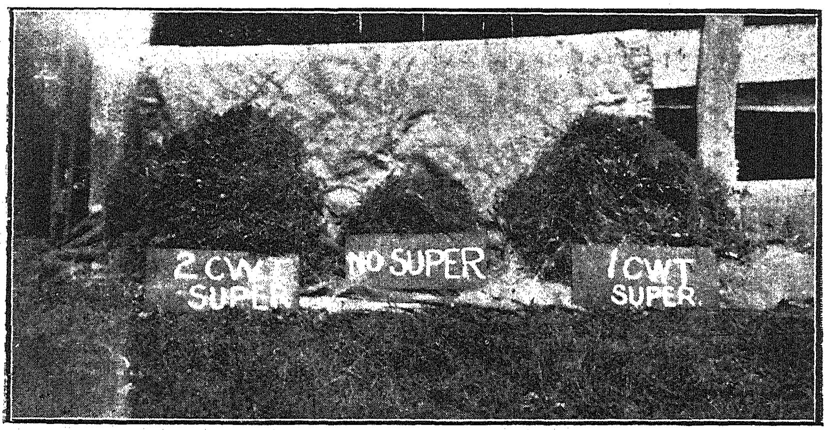
The following table gives the results from those centres where it was found possible to obtain representative sample cuttings from each plot:—

TABLE I.—RESULTS OF TOP-DRESSING DEMONSTRATIONS, 1923.

Centre.	1cwt. Super. per acre.		No Manure.		2cwt. Super. per acre.		Date Plot Inspected.
	Weight of growth per acre.	Percentage yields.	Weight of growth per acre.	Percentage yields.	Weight of growth per acre.	Percentage yields.	
	tons.		tons.		tons.		
Narrogin ...	4·320	200	2·160	100	6·480	300	1–11–23
Pingelly	2·710	353	0·810	100	3·240	400	6–11–23
Toodyay ...	2·700	250	1·080	100	2·971	275	5–11–23
York	2·592	120	1·945	100	3·133	160	7–10–23
Bunbury ...	10·073	196	5·131	100	15·933	311	...
Moora	4·321	168	2·565	100	...	...	2–11–23
Northam ...	4·321	133	3·241	100	4·226	130	5–11–23
Katanning ...	2·160	200	1·080	100	2·700	250	13–11–23
Wagin	1·553	308	0·506	100	2·363	467	14–11–23
Harvey	4·433	136	3·241	100	9·655	298	21–11–23
Dwarda	5·942	200	2·971	100	3·241	109	...
Average, 1923	...	204	...	100	...	270	



2cwt. super, per acre. No manure. 1cwt. super. per acre.
Result of top-dressing demonstration, Messrs. Sounness Bros., Mt. Barker, 1924.



Result of top-dressing demonstration, Mr. W. Middleton's Farm, Denmark.

TABLE 2.—RESULTS OF TOP-DRESSING DEMONSTRATIONS, 1924.

Centre.	1cwt. Super. per acre.		No Manure.		2cwt. Super. per acre.		Date Plots Inspected.
	Weight of growth per acre.	Percentage yields.	Weight of growth per acre.	Percentage yields.	Weight of growth per acre.	Percentage yields.	
	tons.		tons.		tons.		
Bunbury ...	1·570	194	0·810	100	2·030	251	28-11-24
Kojonup ...	7·200	444	1·620	100	10·080	622	16-11-24
Mt. Barker ...	6·165	334	1·845	100	7·605	412	18-12-24
Bridgetown ...	2·160	448	0·540	100	3·240	600	2-12-24
Greenough ...	9·720	200	4·860	100	12·964	267	15-11-24
York	0·293	130	0·225	100	0·270	120	3-12-24
Kulikup	1·080	830	0·130	100	1·080	830	3-12-24
Wagin	1·300	138	0·940	100	2·800	295	10-11-24
Balingup ...	1·800	222	0·810	100	1·750	216	2-12-24
Manjimup ...	7·560	127	5·940	100	7·560	127	18-12-24
Busselton ...	1·215	225	0·540	100	1·215	225	12-12-24
Dwarda	12·240	183	6·660	100	12·420	186	13-11-24
Gnowangerup ...	3·330	176	1·890	100	4·900	260	9-11-24
Geraldton ...	5·942	183	3·241	100	7·562	233	20-11-24
Kelmscott ...	6·660	194	3·420	100	5·940	173	17-11-24 (app.)
Narrogin ...	8·910	381	2·340	100	11·610	496	12-11-24
Wickepin ...	1·665	161	1·035	100	1·530	148	12-11-24
Pingelly	10·440	273	3·825	100	14·220	371	13-11-24
Denmark ...	17·640	350	5·040	100	15·840	314	6-11-24
Harvey	3·060	121	2·520	100	3·060	121	13-1-25
Northam ...	0·360	111	0·315	100	0·450	142	2-12-24
Average ...	...	258	...	100	...	305	

For comparing the results of top-dressing with superphosphate between different districts, the columns under "Percentage yields" should be noted. The aim of the demonstration necessitated the use of widely different classes of soil, and it would be inaccurate, for this reason alone, to compare different centres by the actual weights of material cut from the plots.

An endeavour was made to inspect the plots when the herbage showed maximum growth, and was still green, although this was not possible in all cases. This in part, accounts for the low yield obtained in some districts, where the herbage was not cut till dry or semi-dry.

The figures in Tables 1 and 2, representing as they do the results from 11 demonstrations in 1923 and 21 in 1924, conducted on many types of soils, and under varying conditions may be taken as a reliable guide to the value of top-dressing pasture with superphosphate in West Australia.

The average percentage yields for all demonstrations conducted during the two seasons under review are as follows:—

One cwt. superphosphate per acre, 240; no manure, 100; two cwt. superphosphate per acre, 293.

From the results it will be seen that a growth approximating to 2½ times that on unmanured land may be obtained by the application of one cwt. of superphosphate per acre to pasture lands.

An application of two cwt. of superphosphate under average conditions does not seem to be justified, the increased returns in weight of fodder not being comparable with that obtained if double the area were to be top-dressed with one cwt. of superphosphate per acre.

INFLUENCE OF RAINFALL.

When the top-dressing demonstration plots were organised in 1922, it was considered doubtful if success would attend the application of a manure to pasture in districts with an annual rainfall of less than 20 inches. Such encouraging results were, however, obtained in districts with a much less rainfall than 20 inches, *e.g.*, at Pingelly, Wagin, and Northam, that it was resolved to extend the demonstration plots into drier areas. In an endeavour to gain some idea as to the minimum rainfall necessary for the profitable top-dressing of pasture, plots were conducted as far east as Wickepin and as far north as Geraldton.

TABLE 3.—SHOWING RAINFALL AND DATE OF APPLICATION OF MANURE.

No Manure Plots equal 100 in every case.

District.	Percentage Yields.		Date of Application.		Rainfall, 6 months, October 31.	Average annual Rainfall.
	1cwt. Super. per acre.	2cwt. Super. per acre.				
			1923.		points.	points.
Northam ...	133	130	May	4	1,785	1,703
Pingelly ...	333	400	April	27	1,644	1,705
Wagin	308	467	May	15	1,703	1,745
York	120	160	May	1	1,583	1,767
Moora	168	...	May	1	1,870	1,861
Katanning ...	200	250	April	30	2,005	1,839
Narrogin ...	200	300	May	15	2,135	1,976
Toodyay ...	250	275	May	3	2,178	2,126
Dwarda ...	200	109	June	25	2,835	2,465
Bunbury ...	196	311	May	15	3,785	3,653
Harvey ...	136	298	April	26	4,746	3,975
			1924.			
Wickepin ...	161	148	May	1	1,363	1,649
Northam ...	111	142	June	23	1,268	1,703
Pingelly ...	273	371	May	7	1,707	1,705
Wagin	138	295	May	12	1,594	1,745
York	130	120	May	1	1,297	1,767
Gnowangerup ...	176	260	May	1	abt.1,571	1,826
Geraldton ...	183	233	April	23	1,365	1,875
Greenough ...	200	267	May	22	1,569	1,961
Narrogin ...	381	496	May	9	2,060	1,976
Kojonup ...	444	622	May	1	1,902	2,231
Dwarda ...	183	186	April	25	2,873	2,465
Kulikup ...	830	830	May	15	2,362	2,572
Mt. Barker* ...	334	412	July	7	2,785	2,943
Busselton* ...	225	225	May	6	3,022	3,177
Bridgetown* ...	448	600	June	16	3,415	3,398
Bunbury* ...	194	251	April	14	3,152	3,653
Balingup* ...	222	216	May	5	3,673	3,936
Harvey* ...	121	121	April	...	3,890	3,975
Kelmscott* ...	194	173	May	3	4,323	4,302
Manjimup* ...	127	127	May	21	4,027	4,364
Denmark* ...	350	314	April	24	4,510	4,936

* Rainfall for six months ending 30th November.

It will be noted from Table 3 that maximum results from top-dressing do not follow any particular line of rainfall. In order to facilitate a comparison, districts have been arranged according to their rainfall, commencing with those of low annual precipitation. The average rainfall is given, as well as the rainfall for the growing period (six months ending 31st October), during which the demonstrations were carried out.

The results from the tests carried out during the last two years tend to show that the top-dressing of pasture with superphosphate will be profitable in districts receiving upward of 15 inches of rain per annum.

Under the column "Date of application," in Table 3, it will be noticed that the manure was in every case applied in the autumn, and in the majority of cases early in the season, with the first rains. In only one case in a district of low rainfall, *i.e.*, Northam, on 23rd June, 1924, was the manure applied late in the season. The results here were not as good as in other "low rainfall" centres, where the manure had been applied with the first rains.

In order to give ample time for the herbage to grow in districts where an early spring is the rule, *i.e.*, Great Southern districts, and eastwards and north of the Swan River, it is necessary to apply the manure with or before the first rains. There is ample evidence in favour of this rule, and, in absence of evidence relating to late applications, the early sowing of manure is a safe rule to follow.

In the South-West district, however, where the precipitation is heavier, and the growing season lasts into November, applications of manure were made at later dates than the above. At Bridgetown in 1924 and Dwarda in 1923, the manure was not applied until the second and third weeks in June, while at Mount Barker, in 1924, the application was made on 7th July.

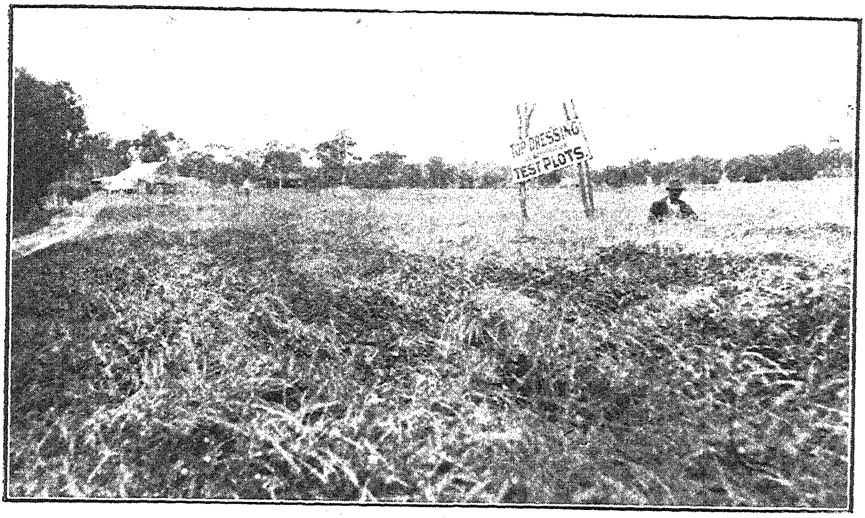
The resultant growth of herbage on the manured plots at all the above places was good. In the South-Wset, however, the majority of plots were top-dressed with the first rains, with good results. These results point to the possibility of the date of application being within wide limits in wet districts, and even that early spring applications migh be profitable.

It is generally recognised that phosphatic manure specially stimulates the root system of plants. This being so, the evidence for a late application of manure to pastures is not strong enough to warrant losing the early growth of feed obtained by applying the manure with the first rains, which practice is the one recommended.

QUALITY OF TOP-DRESSED PASTURE.

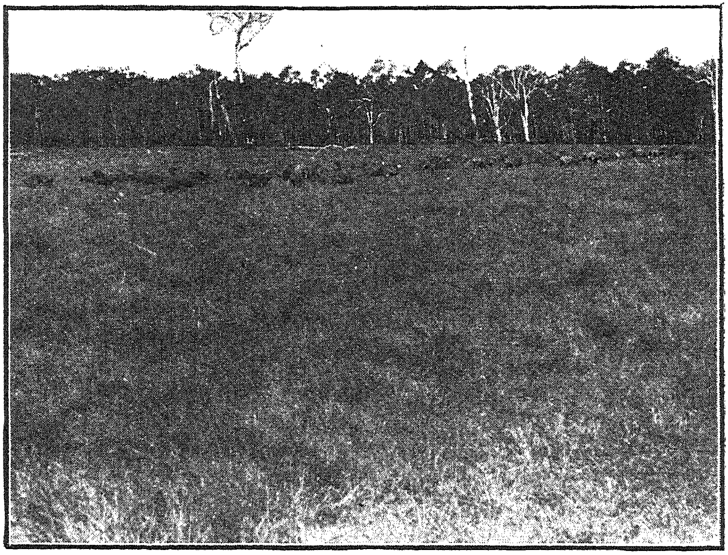
Not the least important result of the demonstrations has been the effect of superphosphate on the quality of the herbage.

It is well known that a phosphatic fertiliser specially stimulates leguminous plants, and it was expected that these plants would be specially stimulated in the pasture, at the expense of the weeds and grasses. Arrangements therefore were made to carefully separate the leguminous plants picked out from the non-leguminous, and weigh, so as to get reliable data on this important aspect of the effect of top-dressing.



Subterranean Clover on Mr. W. G. Argent's Farm, Dwarda. Top-dressed with 1cwt. superphosphate per acre.

The plot on the right top-dressed with 1cwt. superphosphate per acre. Plot on left untreated. Pingelly, 1924.



Sheep on Subterranean Clover, top-dressed with 1cwt. superphosphate per acre. Messrs. Sounness Bros., Mt. Barker.

The following table shows the character of the herbage cut at different centres, the percentage of legumes being given in each case:—

TABLE 4.—PERCENTAGE OF LEGUMINOUS PLANTS.

District.	1cwt. per care.	No manure.	2cwt. per acre.
Narrogin, 1923	50	50	67
Narrogin, 1924	71	12	67
Pingelly, 1923	40	Negligible	67
Pingelly, 1924	75	11	87
Toodyay, 1923	30	12	45
York	45	20	75
Bunbury, 1923	90	90	92
Moora	25	16	Not estimated.
Kulikup	50	10	75
Bunbury, 1924	86	25	95
Mt. Barker	68	Negligible.	72
Bridgetown	45	10	75
Greenough	43	33	55
Manjimup	95	95	95
Dwarda	71	44	83
Gnowangerup	68	19	71
Geraldton	54	Negligible.	64
Kelmscott	69	13	64
Denmark	79	40	95
Average	61	26	71

This table clearly indicates the extent to which the average pasture is improved in quality by the application of a phosphatic manure. It must be borne in mind, however, that the increase in the percentage of legumes, through top-dressing, does not necessarily imply that the number of leguminous plants is greater, but rather that the individual plants have made better growth. Unless seeds or small-stunted plants are present on land to be top-dressed, manuring cannot possibly have any beneficial effect.

Coincident with these demonstrations, the Department carried out experiments designed to elucidate the second aim, stated at the beginning of this article, namely, to find the most economical manures to apply.

These experiments were carried out in duplicate, using a "no manure" plot as the basis of comparison. Mr. A. B. Adams, of the Dairy Branch, supervised the work of carrying out these experiments.

Experiment 1 was designed to test the relative merits of basic slag and superphosphate.

The following shows the arrangement of the plots in these experiments:—

Plot No. 1—No manure.

Plot No. 2—200lbs., 17 per cent. superphosphate per acre.

Plot No. 3—200lbs., 17 per cent. basic slag per acre.

Plot No. 4—No manure.

Plot No. 5—200lbs., 17 per cent. superphosphate per acre.

Plot No. 6—200lbs., 17 per cent. basic slag per acre.

Plot No. 7—No manure.

Experiments on these lines were carried out on the following farms:—

TABLE 5.—RESULTS WITH BASIC SLAG AND SUPERPHOSPHATE.

Name of Farmer and District.	No Manure.	Per-centage Yield.	Superphos-phate.	Per-centage Yield.	Basic Slag.	Per-centage Yield.
	tons.		tons.		tons.	
W. Waters, Balingup (1923)	0·404	100	1·406	348	1·005	249
Do. (1924)	0·252	100	0·801	316	0·534	200
W. Arnott, Jarnadup (1923)	1·620	100	5·940	366	5·400	333
Do. (1924)			Eaten by	stock.		
Average	...	100	...	344	...	261

The plots at Balingup were top-dressed in 1923 but not in 1924. This was done so that the residual effect of superphosphate and basic slag could be compared. Although it is probable basic slag will show results over a longer period than superphosphate, these experiments point to the advantage being with superphosphate, over a two-year period. It is not possible, however, to be final on this point, as the experiments have only been carried out two years.

It is worthy of note that both in these experiments and the previous demonstrations described above, superphosphate has shown consistently good

results in South-West districts with a heavy rainfall. This will come as a surprise to some farmers, as it is quite common to hear the opinion that in a district of heavy rainfall, superphosphate, containing as it does water soluble phosphoric acid, will be washed out of the soil with the first heavy rains.

In practice, soon after superphosphate is added to an average soil, provided moisture is present, reversion takes place to the form of lime phosphate containing two parts of lime to one of phosphoric acid. This form, though insoluble in water, is soluble in weak acids, such as carbonic acid present in most soils, and can be utilised by plants quite readily.

Last season (1924) a portion of the plot which received 200lbs. superphosphate in 1923 at Balingup was top-dressed with 100lbs. of superphosphate with the following results:—

TABLE 6.

No Manure.		200lbs. Super., 1923		200lbs. Basic Slag, 1923.		200lbs. Super., 1923. 100lbs. Super., 1924.	
Tons.	Percentage Yields.	Tons.	Percentage Yields.	Tons.	Percentage Yields.	Tons.	Percentage Yields.
0·252	100	0·801	318	0·534	200	2·151	854

The point to notice in these results is that the plot which was manured again the following year was easily better than any plot manured only the year before.

Mr. A. B. Adams, who supervised this experiment, remarked:—"When inspected during the growing period, that part which received 100lbs. superphosphate in 1924 was much more forward in growth than the rest, and at no time was the residual value of the basic slag applied in 1923 greater than the residual value of superphosphate applied at the same time."

Experiments were also initiated last season to endeavour to find an economical manure which would show more marked residual effect on soils where superphosphate would be likely to revert to very insoluble forms rapidly, *i.e.*, on ferruginous soils. With this object in view, mixtures calculated to produce a basic phosphate were used, the plots being manured as in the following table:—

Plot No. 1—No manure.
Plot No. 2—Superphosphate, 300lbs. per acre.
Plot No. 3—Superphosphate, 200lbs. per acre, plus ground rock phosphate, 100lbs. per acre.
Plot No. 4—Superphosphate, 300lbs. per acre, plus ground limestone, 50lbs. per acre.
Plot No. 5—No manure.
Plot No. 6—Superphosphate, 300lbs. per acre.
Plot No. 7—Superphosphate, 200lbs. per acre, plus ground rock phosphate, 100lbs. per acre.
Plot No. 8—Superphosphate, 300lbs. per acre, plus ground limestone, 50lbs. per acre.
Plot No. 9—No manure.

The manures were mixed prior to being spread on the land, so as to revert the monocalcic phosphate in superphosphate to the dicalcic form, insoluble in water.

Experiments based on the above were carried out by Mr. A. B. Adams, Agricultural Adviser, at Bridgetown and Balbarrup, during last season, the first year's results being given below.

TABLE 7.—TOP-DRESSING WITH BASIC PHOSPHATES.

District.	No Manure.		300lbs. Super.		200lbs. Super., 100lbs. Ground Rock Phosphate.		300lbs. Super., 50lbs. Agricultural Lime.	
	Tons.	Percentage Yield.	Tons.	Percentage Yield.	Tons.	Percentage Yield.	Tons.	Percentage Yield.
L. Naylor, Bridgetown* ...	1·080	100	2·330	216	2·160	200	2·700†	250
F. Liddlelow, Balbarrup ‡	6·480	100	10·800	167	10·800	167	11·340	175

* Weighed as hay. † 80lbs. Lake Clifton lime. ‡ Weighed green.

QUALITY OF LAND.

Bridgetown.—Red loam, indigenous timber, Blackbutt and Red Gum.

Balbarrup.—Chocolate loam, indigenous timber, Blackbutt, Jarrah, and Red Gum.

In these experiments it was also noticed that the leguminous plants were specially stimulated by application of the phosphatic manures, the figures for the Bridgetown plots being as follows:—

PERCENTAGE OF CLOVERS.

No Manure.	Super. 300lbs. per acre	Super. 200lbs. plus Ground Rock Phosphate 100lbs.	Super. 300lbs. plus 80lbs. Lime.
10	70	70	85

CONCLUSIONS.

In brief the inferences to be drawn from the foregoing experiments are as follows:—

1. Top-dressing with a phosphatic manure greatly increases the carrying capacity of pasture on the average about 2½ times.

2. Superphosphate gives as good results as any other phosphatic manure in all portions of the State. Owing to it being the cheapest manure per unit of phosphoric acid, it is to be preferred to other phosphatic manures.

3. One cwt. of superphosphate per acre is more economical than two cwt. per acre. It is preferable to top-dress 20 acres with one cwt. per acre than 10 acres with two cwt. per acre.

4. It is advisable to apply fertiliser early in autumn with the first rains. This period may be extended somewhat in wet districts with a long-growing period.

5. Maximum yield bears little relation to the rainfall, but top-dressing is a sound practice with districts having a "growing-period" rainfall of 16 inches or over.

6. An application of a phosphatic manure specially stimulates clovers and other legumes.

7. Weeds are gradually forced out of the pasture.

8. Results have been equally good on poor soils as on rich first-class lands, showing that all pasture lands need a phosphatic manure.

9. Where stock have been grazed on the plots, they have confined their attention to the manured portions, showing pasture more palatable.

CELLAR AND VINEYARD NOTES.

H. K. JOHNS, Viticulturist.

APRIL.

In the cellars let "cleanliness" be your motto. Remove such odds and ends that favour multiplication of the vinegar fly-fermentable refuse, skins, lees, and skimmings, etc. Drains should be cleaned daily. Dry lime should also be used on floors and drains.

MAY.

Cellar.—Attend to dry wines. When a lighted match will burn in the bung hole fermentation has completed, then rack and fill up. Sweet wines should also be racked and fortified to full strength.

Vineyard.—For new plantations, ploughing and sub-soiling should be done as early as possible. In feeding-off, sheep should not be allowed in vineyard until all leaves have changed colour. Plough early and deep. Manures should be applied. Peas, etc., for green manuring, should be sown to take advantage of early rains.

JUNE.

Cellar.—Keep all young dry wines well filled. First racking of young wines to be completed. Rack older wines. For this work choose fine weather, if possible.

Vineyard.—Pruning to be commenced. Ground for new vineyards to be marked out in readiness for planting. Manures to be applied.

SEED TREATMENT FOR OAT SMUT.

W. M. CARNE,
Botanist and Plant Pathologist.

Recently a number of inquiries have been received in regard to the treatment of oats for the prevention of smut, and the following information should prove of interest:—

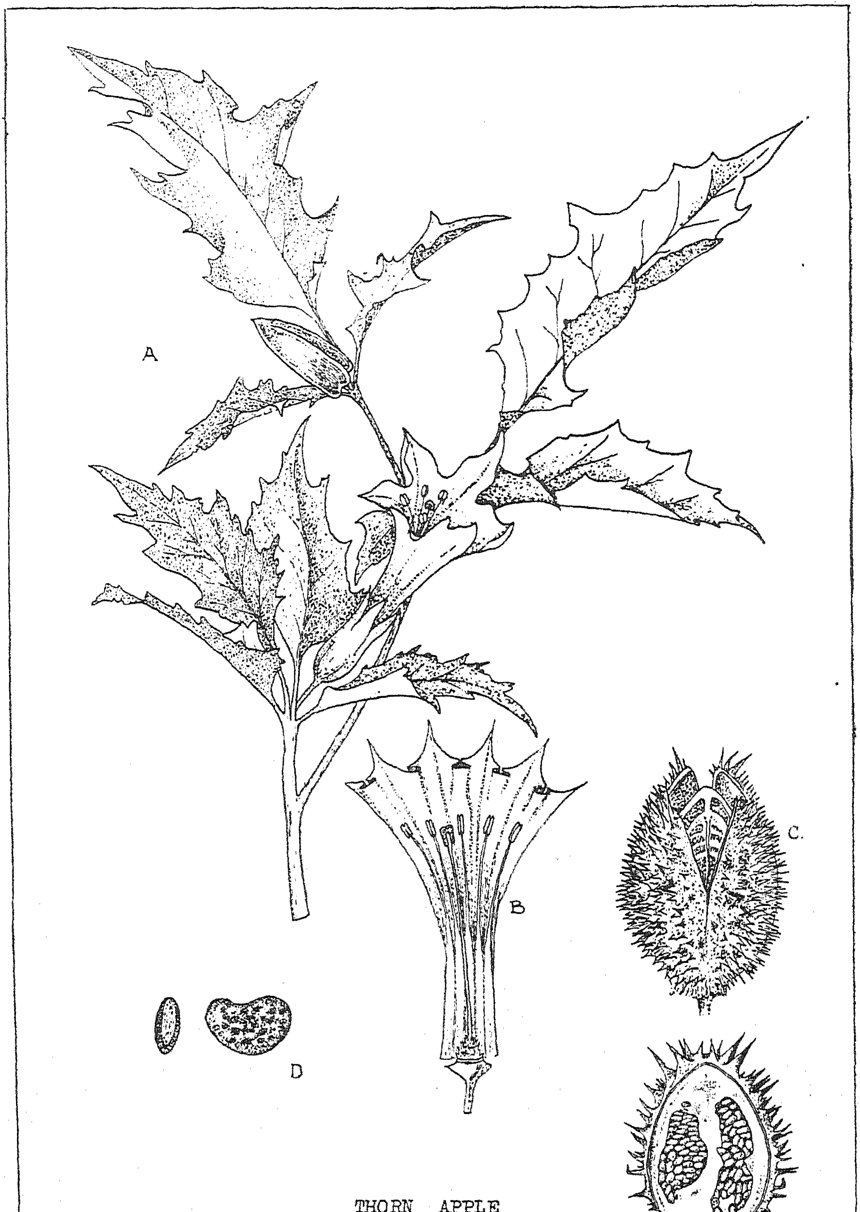
The use of formalin, or bluestone, is more reliable than the dry treatment with copper carbonate dust. The ordinary pickling method with liquid solutions requires the grain to be soaked for one and a-half to two hours for effective results, and this makes the seed difficult to dry sufficiently to run through the drill, while it is not advisable to sow the soaked seed in dry soil. The following method is effective, and has the advantage that the grain is more readily dried:—

Place the grain in a heap on a clean floor. Sprinkle with a formalin solution from a watering can as the grain is shovelled from one heap to another. Cover the heap with bags wetted in the same solution for six to eight hours, then spread the grain to dry. Sow as soon after treatment as possible. The solution is made by adding one pound of formalin to 30 gallons of water, and is used at the rate of about one gallon to one bushel. This treatment is also effective for covered smut of barley.

A RECORD AGED HOLSTEIN PRODUCER.

Apparently surfeited with the record yields of individual animals, American dairymen are seeking new standards of production for age. Pauline Brightview, No. 113,832, a pure-bred Holstein, owned by Dairy Hill Farms, of Ohio, has just completed what is believed to be a world's record for cows 15 years and over. Her yield for seven days, made at the advanced age of 15½ years, and after dropping her twelfth calf, was 21.47 lbs. fat (26.84 lbs. butter, 80 per cent. fat), from 551.7 lbs. milk. Last year she broke the world's record for a 14-year old cow by producing 24.04 lbs. fat (30.05 lbs. butter) in seven days, and 98.4 lbs. fat (123 lbs. butter) in 30 days. As a nine-year old she made a strictly official year record of 895.76 lbs. fat and 25,606 lbs. milk.

The record of Pauline Brightview as a mother is almost as imposing as her record as a producer. In twelve freshenings she has dropped five daughters and seven sons. Her oldest daughter and first calf is a 1,000 lb. cow, and has had six daughters and two sons. Her second daughter, a 28 lb. cow, has had three sons and two daughters, and her third daughter, a 900 lbs. cow, has had three daughters and two granddaughters.—"Australian Farming."



Explanation of Plate—
A.—Flowering branch.
B.—Flower in section.
C.—Ripe fruit, and fruit in section.
D.—Seeds (magnified).

THORN APPLE.

(Datura Stramonium, Linn.)

W. M. CARNE, Botanist and Plant Pathologist, and
C. A. GARDNER, Assistant.

Thorn Apple is an annual summer-growing weed found in waste places and in summer crops in the agricultural areas of this State where the soil is moist during the summer months. Originally a native of Asia, it has been introduced into most of the warm and temperate regions of the globe, and is now fairly common in all the Australian States.

Although commonly known as "Thorn Apple," this plant has a number of local names in different countries. In Australia, particularly in the Eastern States, apart from the above name it is known as "Castor Oil" and "Wild Castor Oil," thereby causing some confusion, as the true Castor Oil plant (*Ricinus communis*), so common in the waste spaces of the metropolitan area in this State, belongs to quite a different family. The Castor Oil plant is a shrub or small tree, while the Thorn Apple is much smaller, and not woody The only points held in common by the two species are a similarity in the shape and prickles of the fruit.

On account of its poisonous principle, Thorn Apple has been known from the earliest times. The name *Datura* is derived from a name probably of Sanskrit or Persian origin, applied to this plant, or a sister species. The specific name—*Stramonium*—is an abbreviation of the Greek for Mad Apple; the priests of Apollo were supposed to use the seeds of this plant to produce the paroxysms associated with the Delphic Oracle.

Thorn Apple is one of our noxious weeds, and is a poison plant. As such, the importation of the seeds is prohibited under the Agricultural Seeds Act. We have no record of its earliest appearance in this State, although it is improbable that it appeared here before 1865. Within the last few years it has attracted some attention from its appearance in Sudan Grass grown from seeds obtained from the Eastern States, although its occurrence in the metropolian area at least, dates much further back. Being of a succulent nature, and living in the summer months, it follows that Thorn Apple will be most prevalent where the soil is moist during summer, therefore its presence is likely to be most noticeable in the moister pastures and cultivations, and near creeks and swamps. Stock as a rule avoid the plant on account of the unpleasant odour and strong bitter taste of the leaves.

A Poison Plant.

Thorn Apple is a poisonous plant containing the alkaloids *daturine*, *hyoscyamine*, and *atropine;* all the parts are stated to be poisonous, particularly the seeds. Concerning the leaves there is rather conflicting evidence, but in the United States of America there are cases on record where cattle have been poisoned from eating the dried leaves mixed with hay. The toxicity of the plant is not destroyed by drying. The seeds are certainly poisonous, and have proved fatal to adults, children, and live stock in several instances. The symptoms of poisoning in stock include paralysis, dilated pupils of the eyes, and convulsions, and may terminate in death.

The seeds are used by some of the natives of India and South America in the preparation of an intoxicating drink, and to some extent medicinally. They are also used to poison enemies.

The leaves of Thorn Apple have been recognised for some time, both in Europe and Australia as a remedy for asthma. They are usually dried and mixed with tobacco for smoking, or they are smouldered with saltpetre, and the fumes inhaled. "Stramonium" cigarettes and cigars have been manufactured in Europe for upwards of sixty years.

Control.

In the eradication of Thorn Apple it is important that the plants should be pulled up or hoed out before they are allowed to seed, and it is desirable to burn the plants in order to lessen any risk of seeding or poisoning. There are cases known where serious injuries to the eyes have resulted from persons rubbing these organs with the hands while pulling up the plants, and, since permanent injury may result it is advisable to exercise care. Where the plants are numerous and individual eradication may prove costly, thorough cultivation of the young plants, succeeded by harrowing is an effective measure in suppressing the weed, but an outlook should be kept in order to see that none of the plants which may survive mature and seed. The facts that stock usually avoid it, and that it is a free producer of seeds, aid the plant in spreading rapidly in favourable localities, but it is improbable that this weed will ever become common in the dry areas.

When buying seeds of Sudan Grass farmers should examine the same, and refuse to accept any containing Thorn Apple seeds. These may be easily distinguished from the grass seeds, as they are larger, black and shining, somewhat kidney-shaped and rough.

Description of the Plant.

A rather succulent, disagreeably-scented plant of two to three feet in height, with forked branches bearing between them, or at their extremities solitary, shortly-stalked flowers. The leaves are rather large, dark green, and soft, irregularly toothed, and paler on the underside. The flowers are white, two to above three inches in length, tubular or trumpet-shaped, with five short, often yellowish, points. The fruit (a capsule) is roughly globular, beset with numerous stout conical prickles, about 1½ inches long, opening in four valves. Seeds black and shining, kidney-shaped, pitted with shallow hollows. The plant flowers during summer.

A purple-flowered Thorn Apple (*Datura Tatula*) is perhaps a variety of *D. stramonium*. It has not been recorded from Western Australia.

Some species of the *Datura* are cultivated, one fairly well-known in Western Australian gardens is the shrubby "Trumpet-flower," known to horticulturists as *Brugmansia*.

POISONING TREES AND BLACKBOYS WITH ARSENIC.

P. H. Harper, Gingin.

The following notes are based upon my experience with arsenic for killing growths preparatory to clearing.

Arsenic does not take the place of gelignite if one wishes to clear within 12 months. The explosion prevents suckering and kills instantaneously.

Arsenic is not very satisfactory for Zamia palms. If a crowbar is well worked round after being stabbed into the heart at the beginning of winter arsenic can be expected to be about 50 per cent. effective. Its action is very quick, but many of the plants may recover. A small quantity of kerosene poured into the heart is the most effective way of killing this plant.

I have found the use of arsenic to be effective on York gums (*Eucalyptus foecunda var. loxophleba*), Swamp or Flooded Gums (*E. rudis*), Paperbarks (*Melaleuca spp.*), and Blackboys (*Xanthorrhoea spp.*).

In killing trees they should be chopped down level with the ground, if small, leaving a hollow in the centre. The solution should be poured slowly on to the centre of the cut surface so as to allow the liquid to sink in. Trees too big to chop down should be frill-ringed close to the ground, cutting downward and deeply. The solution should be poured slowly into the cut. The higher the cut is made above the ground the more solution will be required. It will take twice as much axe-handle high as at ground level.

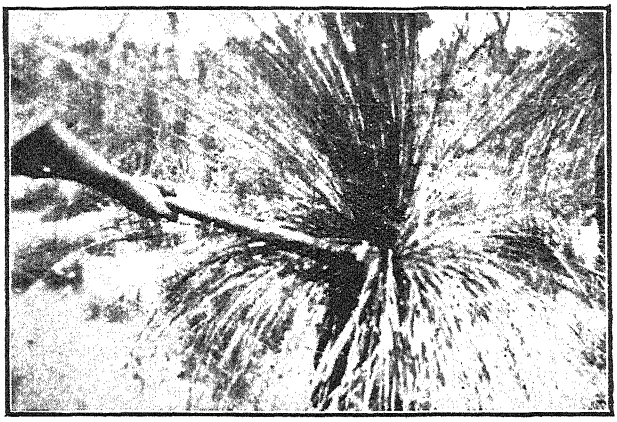


Fig. 1.—Blackboy showing position and angle of blow for flying the top.

With blackboys use a long and narrow-bladed axe, such as the axe end of a grub hoe with the hoe end cut off. Fly the tops of low blackboys by hitting at the bottom of the erect clump of green leaves (Fig. 1). Pour the solution into the cup so formed (Fig. 2). With tall plants make one, two, or three cuts according to diameter into the white as near the roots as pos-

sible, and pour the solution into the cuts. The amount of solution required varies with the height and thickness of the stems. One gallon will do from 60 to 180 of the shorter plants.

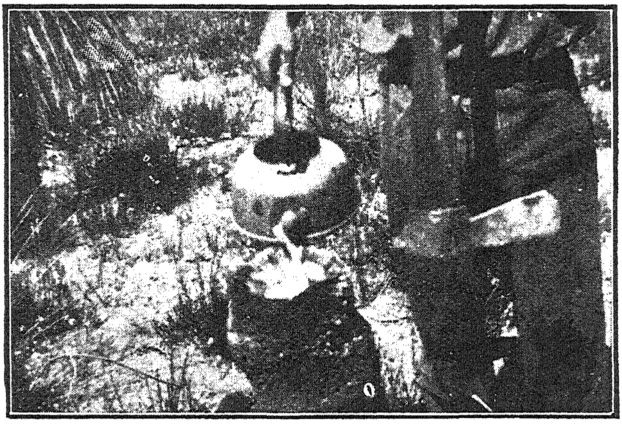


Fig. 2.—Blackboy showing method of applying solution and type of home-made axe found very suitable.

In all cases the best time to operate is when the sap is not moving. This is usually about February or March in dry soils or in winter in soils moist in summer.

To prepare the solution place 15 gallons of water in a 20-gallon vessel (such as a carbide drum). Add 20 pounds of caustic soda, then stir and add 56 pounds of white arsenic while stirring; dilute to 56 gallons for trees and 168 gallons for blackboys. Care must be taken not to inhale the soda dust, and in handling the arsenic, owing to the caustic nature of the former and to the latter being deadly poisonous.

LAYING NATURAL.

For Good Hen.

It is well to remember that the good hen continues laying because it is the most natural thing for her to do. If she is well fed and has good surroundings, the good hen will produce the eggs. But if she is neglected the good hen will not produce the eggs. If it is possible to so feed the hens that they cannot stop laying, then we have accomplished much in increasing returns, but if the feed is being carried out on what is often termed hard lines, that is giving the birds as much as they will eat, it is not wise to be keeping drones. Culling must, therefore, be practised vigorously. But when you have been over the flock and the birds appear to be laying well, avoid all sudden changes in feeding.—"Victorian Poultry Journal."

THE ZAMIA PALM AND ITS DESTRUCTION.

A. B. ADAMS, Dipl. Agric.,
Agricultural Adviser, Dairy Branch.

It has long been known that the cattle trouble known as "Palm Rickets" or "Wobbles" is caused by the Zamia Palm (*Macrozamia Fraseri*). Unfortunately but little definite experimental work has been undertaken to find the conditions under which cattle are mostly likely to contract the disease. It is highly probable that the effect depends more on the ratio of palm to other food eaten rather than on the actual amount of palm ingested. Certainly the most dangerous time for cattle is when running on burnt country, when the young palm leaves are almost the only food available, and compose approximately 100 per cent. of the diet, *i.e.*, when cattle are practically on a starvation diet.

The poisonous principle which causes the trouble has not been definitely proved, but the Government Analyst isolated acid potassium oxalate from the plant, and the writer found 0.4 per cent. of oxalic acid in the dry matter of the half-grown nut. It is also of interest to note that the symptoms are much like those of oxalic acid poisoning.

It is possible that if the cattle were receiving a good ration of clover-hay, or other fodder rich in lime salts, or were receiving bone meal or other lime phosphate regularly, they would not be so liable to contract the complaint, lime being the antidote for oxalic acid. Oxalic acid combines with lime to form oxalate of lime, which is very insoluble except in strong acids, the weak acid of the stomach not being able to dissolve it.

Although we are largely in the dark in definite knowledge of the poisonous principle and its action, we may be quite sure that if there are no zamias the cattle will not develop palm rickets, so it will be wise for the settler to endeavour to eliminate the palm from his holding, and the greater the number of palms per acre the more important is their destruction. It can hardly be too much impressed that the destruction of palms within the boundaries of a settler's holding is an entirely wise and profitable work, and an effort should be made to kill all that are growing on his land.

METHODS OF DESTRUCTION.

The method requiring the least outlay is to drive a sharpened steel bar well into the heart of the plant, give it a good turn to make the palms give in the centre, withdraw, and repeat in the next. This is most effective when done in the rainy season, as the water runs into the heart of the plant, and sets up a rot which kills it.

Although this is the least costly in outlay on materials, it is probably a good deal dearer than the methods following, as it is much harder work, and therefore costs more in labour.

The quickest and easiest method is to poison the plants with—

(a) voco kerosene;

(b) arsenite of soda (1lb. arsenic to 4 gallons).

Recent experiments on a small scale have satisfied the writer that of the various methods applied, the kerosene treatment is the most satisfactory. The arsenite of soda may be equally good if there is a long spell of dry weather immediately after the palms have been treated. Mr. Dunnet, of Nannup, reports that he killed over 300 acres of palms on coastal country near the Scott River, and that few, if any, grew again; he used a slight variation of the usual solution. After boiling arsenic and soda together in water, at the rate of one pound of white arsenic to two of washing soda in one gallon of water, it was diluted to make about four gallons of solution to the pound of arsenic. To make the solution and palms distasteful to stock, a kerosene-soap solution, similar to that used for spraying, was prepared, and one pint of this kerosene solution was added to every five gallons of arsenite of soda solution. Although used in such dilute quantity, Mr. Dunnet informs me that a smell of kerosene was noticeable at the base of the fronds of the dead plants 18 months afterwards. It is, of course, possible that this small amount of kerosene had some effect on the plant, as Mr. W. Harper reports that on his property palms treated with arsenite of soda died to all appearance, but afterwards made fresh growth. The writer has had the same experience when carrying out the following experiments:—

EXPERIMENTS IN PALM DESTRUCTION.

At Mr. Fromes, Picton, on 8th and 9th July, 1924, a quantity of palms were treated in the following manner:—

(1) Pulled out centre frond of palm and poured in one eggcupful of arsenite of soda.

(2) Poured one eggcupful of arsenite of soda into centre of plant.

(3) Poured two eggcupfuls of arsenite of soda into centre of plant.

(4) Centre frond of palm pulled and treated with half eggcup of power kerosene.

(5) Poured half eggcup power kerosene into centre of plant.

(6) Drove crowbar well into centre of plant.

(7) Crowbarred plant and treated with eggcup of power kerosene.

(8) Pulled centre frond of plant and treated with eggcup of power kerosene.

(9) Poured eggcup of power kerosene into centre of plant.

When visited on 23rd July it was found that the centre leaves of all those treated with arsenite of soda were dead or dying. All those receiving kerosene were feeling its effects, but to all appearance were not dying as quickly as those which had arsenite of soda. The crowbarred plants had suffered least of any.

On 23rd September the experimental area was again inspected and the results were found to be much the same as on the previous visit, but some of the plants appeared to be quite dead.

On 5th February, 1925, a further visit was paid, when the following results were noted. The results are numbered in the same order as the experiments above:—

(1) Of those treated, and of which 100 per cent. were apparently dead on a previous visit, 37 per cent. were making fresh growth from the centre.

(2) Of these, 75 per cent. were growing again.

(3) These, which were small plants and received double the quantity of poison, were all dead.

(4) Palms completely dead and fronds brown.

(5) Palms dead, green tips to some of the fronds.

(6) Sixteen per cent. growing again; balance dead.

(7) All plants dead.

(8) All plants dead.

(9) All plants dead.

These results would tend to prove that kerosene is, up to date, the most reliable method of destruction. As a check another lot of palms were treated at Mr. Maidment's, Picton, on 23rd September, 1924. In each case the fronds at the centre of the plant were pressed open with the left hand for convenience of pouring with the right, but no attempt was made to prepare the plant by barring or pulling out the centre frond. The trials were arranged as follows:—

(1) Large palms (those with about ten or a dozen fronds) received an eggcup of kerosene, small plants (with three to five fronds) received half an eggcupful.

(2) Large palms, as above, received an eggcup of arsenite of soda.

These plants were visited on 16th November, when it was found that all the plants were dead or dying, but those treated with arsenite of soda were dying much more rapidly than the rest.

On again visiting them on the 5th of February, all those treated with kerosene were almost, if not quite, dead, and those which had been dead the longest were showing no signs of regrowth. All those treated with arsenite of soda had died down completely, but had then started to make fresh growth, and many of them had a fresh bunch of fronds in the centre six inches high.

In the light of these facts, the use of arsenite of soda for palm destruction can no longer be recommended. It is, of course, quite probable that these results are partly due to the poison being diluted with rain which fell after the plants had been treated, or from the poison being too weak. As it cannot be said, in the South-West we are ever certain it will not rain, and if the poison is made much stronger, its great advantage, its cheapness, will be lost, it can be definitely recommended that the farmer should pin his faith to kerosene.

Mr. James Butcher, of Kelmscott, who reports that he has killed thousands of acres by the kerosene method, was good enough to communicate his experience to the writer, and says, *inter alia*, "Power kerosene used in the summer is best, but that it can be done at any time of the year except when raining. This is probably because when actually raining the kerosene floats on the water in the heart of the plant and runs away. If it once gets an opportunity to soak in, further rain is not likely to affect it much." He also states, "He killed about 1,000 palms with a case of kerosene. At that time it cost him about ninepence per acre, with kerosene at 7s. 6d. a case, as against 6s. for stabbing with the bar." As both labour and kerosene are dearer at the present time, the comparative costs will be in about the same proportion.

To get rid of palms in grazing paddocks and in bush country, the best method is to treat the plants with kerosene, and allow the dead plants to be burnt out with fires in the burning-off season.

It will also probably help to keep the stock from eating the palms if as much of the grass as possible is topdressed with superphosphate; it being extremely probable that the craving for palms, which was quite unknown in the early days of settlement, has some connection with the craving for bones and the unnatural appetite caused by a deficiency of phosphates in the feed.

Those without experience of palms are warned not to allow the fronds or other portions of grubbed palms to remain lying where stock can have access to them, as they are more dangerous than the growing plant.

Palm destruction is not usually suitable work to have done on contract, as such a long period elapses before the efficiency of the work can be judged.

In conclusion, it may be stated that in our present state of knowledge, the kerosene method of palm destruction is, for large areas, the cheapest and best. All that is necessary being to pour about an eggcup of kerosene into the centre of each palm, doing the work in dry weather, preferably in the summer.

The treated palms may be marked by bending down a frond on each plant as it is treated or by mixing a little white paint with the kerosene.

DAIRY COWS AND SALT.

It is more essential to provide the dairy cow with an adequate supply of salt than any other animal on the farm, writes the "Australian Farming" of January last. In the manufacture of milk she requires considerable salt, and unless it is provided in liberal quantities she will develop an abnormal appetite, dull eyes, a rough coat, and in the end there will be a complete breakdown. Dairy cows require varying quantities of salt. Those who are producing large flows require more than those producing small quantities. In a feed report of one of the leading dairy cows, it was stated that she consumed 50 lbs. of salt in a year, or more than two ounces per day. This seems like a generous quantity of salt, but it was none too much considering the work that she did in the year. A practice sometimes adopted is to mix with each 100 lbs. of feed from one-half to one lb. of salt, and at the same time arrange that the cows may also have free access to salt. With this method the animal is certain to obtain all the salt she requires.

THE DEVELOPMENT OF A DAIRY HERD.

(Conclusion.)

P. G. HAMPSHIRE,
Dairy Expert.

"TESTING" AND "CULLING."

In previous issues of the *Journal* articles have been written dealing with the "selection," "breeding," "feeding," and "management" of a dairy herd, and it is now proposed to deal with "testing" and "culling."

It may be mentioned that the whole fabric of the development of a profitable dairy herd, including the proper and satisfactory selection of stock, the breeding of dairy stock, the economical feeding of dairy stock and their management are all wrapped up in and are guided by testing. It is desired to stress to dairy farmers that the testing of their cows—in order that they may be in a position to determine their production—is a fundamental part of the work of the management of their dairy herd. It has been proved beyond any doubt that, without testing, the farmer is not in a position to say which are his best cows, which are his most profitable animals, whether he is feeding them economically, and whether the dairy sire being used is worth keeping.

Experiments have been conducted in different parts of Australia and other dairying countries of the world, where dairy farmers have been asked to select the cows of their herd in the order of merit as regards production as they would place them. The farmer was, in most instances, the man who bred the cows and who milked and handled them always, and yet when he placed those which, in his opinion from his observations, were the best producing animals, it was found that among the best cows he placed were some of the worst cows, and among cows he had not considered were found some of the best cows.

Experiments have been carried out where competent judges of dairy stock have been asked to place cows in their order of production, and it was found that the degree of accuracy of testing was eight times more sure than the placing by dairy stock judges.

The fat content of milk cannot be determined with any degree of accuracy by observing the cream which rises on it after standing. The cream does not rise readily on the milk of some cows, owing to the fat globules in the milk being very small. Again the colour of milk is not a sure guide in regard to its quality.

Instances which have come under the observation of the writer might be quoted to show the necessity for testing to determine the true worth of a cow. On one occasion when giving a testing demonstration in a dairying district, a farmer brought in samples of the milk of two of his best cows.

Cow No. 1 gave 40lbs. milk per day.

Cow No. 2 gave 35lbs. milk per day.

He was particularly interested in the test of these two cows, as during the previous week he had to determine which was the best cow in his herd

to take in to the local Show to compete for the prize offered for the cow giving the greatest quantity of butter fat. He selected Cow No. 1, because she gave four gallons of milk per day. When the two samples were tested it was found that Cow No. 1 produced milk which tested 2.6 per cent. fat, and Cow No. 2 produced milk which tested 6.4 per cent. fat. On computing the result on a weekly basis, it was found that Cow No. 1 produced 7.28lbs. fat for the week, and Cow No. 2 produced 15.68lbs. fat for the week, or more than twice as much butter fat than Cow No. 1. The irony of it was that the cow which won the prize at the Show produced 12.5lbs. fat for the week. Whilst he did not get a place in the competition with the cow he took to the Show, he had at home a cow which would have won easily. Needless to say, this farmer, after the demonstration, was a keen enthusiast in the advantages of testing.

Another case was noted where two cows, which, judged on their appearance, were fairly equal as regards dairy qualifications, and which calved about the same time and were fed exactly the same throughout their lactation period, produced under test as follows:—

Cow No. 1—8,500lbs. milk and 469lbs. fat during period of test, 300 days.

Cow No. 2—3,100lbs. milk and 169lbs. fat during period of test, 300 days.

A striking lesson from this result is that Cow No. 1 required approximately 35 per cent. of her feed as a maintenance ration and 65 per cent. was utilised for the production of milk and butter. Cow No. 2, on the other hand, required 56 per cent. of her feed as a maintenance ration, utilising only 44 per cent. of her feed for production.

[*An extract from the Journal of the Ministry of Agriculture, Great Britain, January,* 1925, *will be found very striking.*]

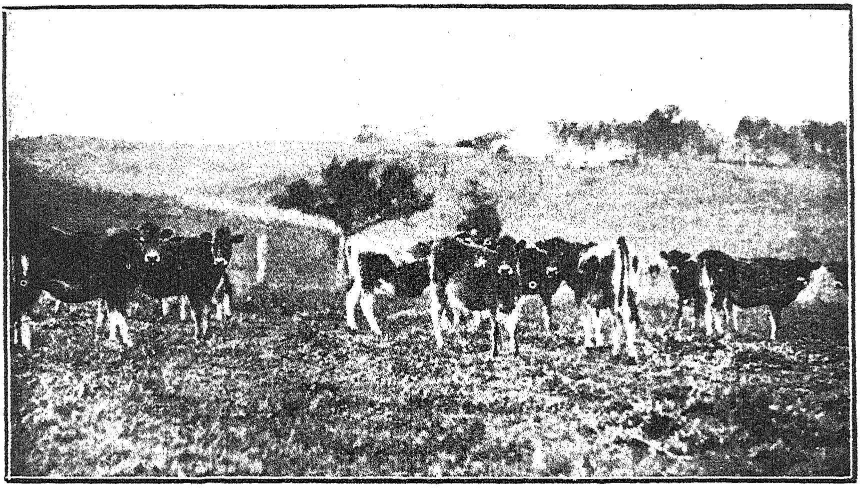
MILK RECORDING SCHEME OF THE MINISTRY.

The following is a striking example of the great difference which exists between herds in their milk-producing value:—

> Two members of the same milk-recording society had 42 cows each. All were recorded for the full year. The average yield of the 42 cows in one herd was 889 gallons; that of the other was 372 gallons. The approximate difference in the total yield was 21,700 gallons, which at one shilling per gallon represents a difference of £1,085 in the gross receipts for the same number of cows.

Cow-testing is the accountancy of dairy farming.—It is the only satisfactory means whereby the dairy farmer may obtain a true account of his results for the year—a true record of the production of each cow in the herd; and, when combined with the costs of feeding, labour, interest on capital, and incidentals, and debited against the production of each cow, he is enabled to ascertain which cows in the herd are the most profitable. A dairy herd may be likened to a departmental store, each cow being similar to the various branches. "Daisy" we will call the Drapery Department, "Beauty" the Millinery Department, "Blossom" the Boot Department, "Strawberry" the Ironmongery Department, and so on; all these branches have a manager. At intervals the general manager goes into the profit and loss of

each department. If the Boot Department ("Blossom") is not showing a profit, the general manager pointedly asks the branch manager the reason, and if he cannot remedy the matter, he is dispensed with, and another manager is put in his place. If "Blossom" at the end of the year, as a result of testing, is showing a loss and cannot put up a satisfactory reason, that is, on account of sickness or other circumstances, "Blossom" should be *culled* out. Each department or each cow should show a profit over cost of working.



A nice batch of heifers from "proved" cows to build up the herd.

Cow testing determines which are the best Heifer Calves to keep.—The necessity of having a production record of each of the cows in the herd is an obvious advantage in enabling the farmer to determine which of the heifer calves he will keep to replenish and build up his herd. Without a test record of the dams he may easily make the mistake of selling his best heifers and keeping his worst, as he cannot tell which are likely to be the most profitable heifers by appearance always. If, however, their dams are the best producers in his herd and their sire is from a high-producing cow, he can bank on these heifers being good producers.

Cow testing proves the economy of Feeding.—When a farmer is weighing the milk of his cows periodically and testing for butter fat, he is in a position to know whether it is economical to feed "Daisy," "Blossom," or "Beauty," as the case may be, with the various quantities of feed he is giving them. He probably will find that, if "Beauty" were given, say, 2lbs. more bran and a few pounds more lucerne hay per day, she will more than pay for the cost of that feed by her increased production. On the other hand, he may find, too, that "Daisy" is not showing a sufficient margin of profit over the cost of feed she is receiving. By reducing the quantity of feed to this cow she may show a profit. Another factor is that he is in a position to know the result of any change of feed in a proper and satisfactory manner. He finds perhaps that, on turning his herd from one paddock to another, there is a decided increase in yield. He also finds, as the result of

the weighing of milk and testing, that, if the cows are being underfed as the result of the pasture becoming shorter, it would pay to purchase concentrates or feed clover hay, lucerne hay, or oaten hay in addition to pastures.

Where a farmer is supplying butter fat to a butter factory, it is essential that he should determine all results on a butter fat basis. Even in the case where a farmer is selling the produce of his cows as whole milk, the advantages of weighing the milk are obvious as it is the only way in which a true record can be kept.

See that the cows keep you; do not keep the cows. Find the duffers and cull them out.

Cow testing proves the Dairy's Sire's worth.—Unless the dairy farmer is testing the daughters of the bull he is using, he is not in a position to determine whether this bull is worth keeping. He may be keeping a bull whose progeny are deteriorating his herd and reducing the average production. On the other hand, he may dispose of a bull whose daughters are a decided improvement on their mothers. How often does one come across a farmer who regrets that he sold such and such a bull to the butcher. Herd testing means the use of better bulls. Dairy farmers are enabled to find out the truth about the wasters and get rid of them; and, as the result of their knowledge of testing and its value, they look for a bull whose dam was an officially tested producer to take his place. Herd Testing Associations generally mean the formation of "Bull" Associations. Where farmers club together and have their cows tested as the result of the benefit they receive and the knowledge they have of their herds, they go further and find that they can profitably go in together and purchase high quality bulls, whose ancestors are proved high producers, for community use.

Testing makes Cow-keeping an interesting occupation.—The majority of dairy farmers who are testing find the working out of these results interesting and even fascinating. The dairy farmer has an intimate knowledge of the production of each animal in his herd. He watches the even production of one cow, how she hangs on to her production month after month, and, although she may not start as well as another cow when she freshens, she is catching up and even passes her towards the end of the lactation period. "Daisy" is a "stayer," whilst "Beauty," which started off splendidly is fading away. "Beauty" is a "sprinter" pure and simple, and, at the end of the lactation period has been outdistanced or "outstayed" by "Daisy" by even 100lbs. fat.

Dairy farmers who are testing find an interesting half hour in the evenings working out the results of their individual cows and estimating their probable production. It affords food for interesting conversation with their nearby neighbours. Cow testing lifts the drudgery of dairy farming out of the rut and hum-drum of every day life. Herd testing means greater interest in the avocation, better feeding, and improved breeding methods.

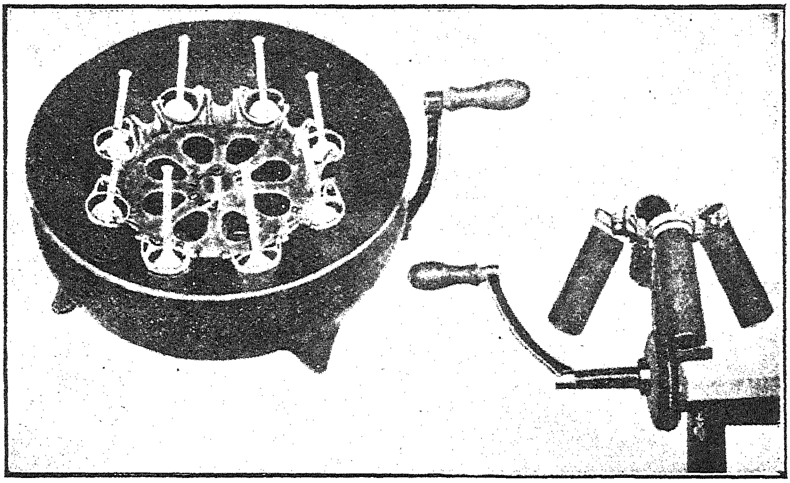
How testing may be carried out.—The testing of dairy herds may be conducted under one of the following methods:—

a. Privately or individually.

b. As a member of a Cow Testing Association (semi-official).

c. As a member of the Pure Breeds Herd Testing Scheme (official).

Where it is not possible to induce a sufficient number of nearby neighbours to form an association for the testing of their cows, farmers are well advised to carry out this work themselves. The outlay in connection with the equipment of a testing machine and apparatus for this purpose is not a big one. A four-bottle tester with all the necessary gear may be purchased for £2 10s. A 12-bottle machine would cost about £8 10s. A description of the method of carrying out testing is supplied with each testing machine outfit purchased. Testing is simple, and may be carried out in the dairy during the slack hours of midday away from the heat in the summer and the wet in the winter.



Types of Babcock Testers.

This Department would welcome teaching dairy farmers to test, and guarantees to turn them out reasonably proficient testers. Generally, managers of butter factories are willing to show farmers how to test.

A brief description of the method of conducting the testing of milk is as follows:—

1. Secure a representative sample of milk. In securing this, it is necessary to pour the whole of the cow's milk from one bucket to another three times, after weighing, and then take the sample in a two-ounce bottle.

2. Mark the bottle with the name of the cow, morning or evening.

3. After thoroughly stirring, measure out the required amount of milk with a 17.6 c.c. pipette, and deliver this into the test bottle.

4. Where samples have been allowed to stand any length of time and the cream rises to the surface, it will be necessary to warm the milk up to about 100 degrees and thoroughly stir to mix the fat.

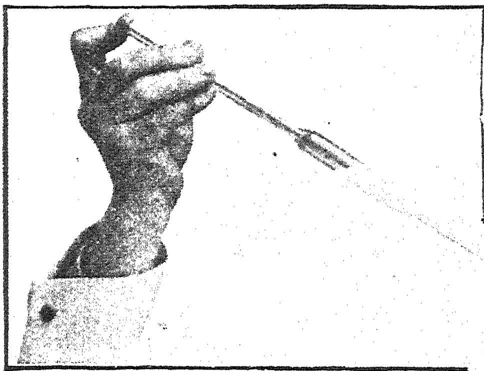
5. Add 17.5 c.c. of sulphuric acid to the milk in the test flask, and mix gently in a rotary motion. Place the flask in the testing machine and whirl at full speed for five minutes. Stop the machine and add hot water at a temperature of about 150 degrees F. to bring the fat up to the bottom of the neck of the flask. Whirl again at full speed for three minutes. Stop the

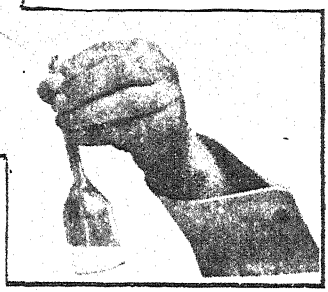
machine and add hot water to the flask to bring the fat in the neck of the flask up to about the eight per cent. or nine per cent. mark. Whirl for two minutes in the machine. Stop and read the test.

6. The test should be read at a temperature of about 140 degrees F. Record the test alongside the milk yield given by the cow.

7. Empty the milk test flask immediately and cleanse, shaking thoroughly to remove sediment in the bottle.

8. Errors in testing are likely to occur as the result of inaccuracy in measuring the quantity of milk and in reading the "fat" column in the test bottle. The "fat" column should be a clear amber colour if the test has been carried out properly. If too dark, it is usually the result of either too much acid or too strong acid being used. If, on the other hand, it is a pale whitish colour, it is accounted for by acid being weak or insufficient being used.



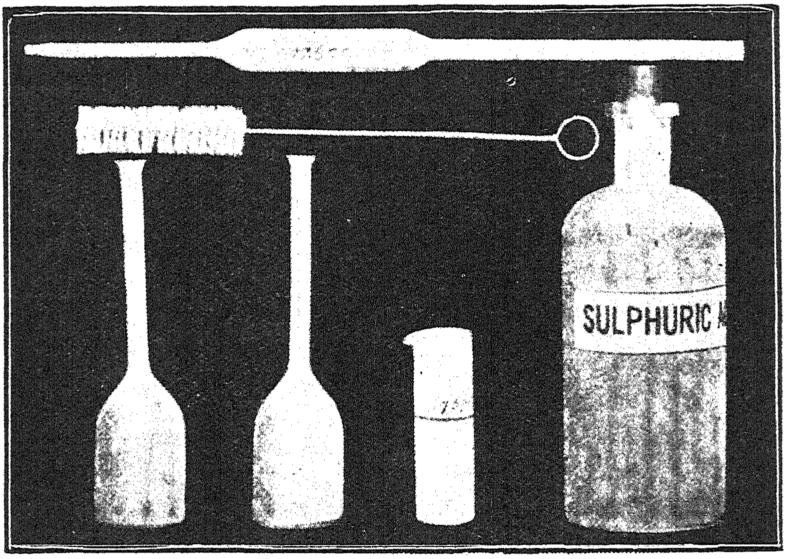


The proper way to pour milk from a pipette into the testing flask.

b. Where a sufficient number of farmers in one district can be got together, the formation of a Herd Testing Association (semi-official) will eliminate the work of testing individually. Such associations are formed by the association of 25 dairy farmers within a radius of from 15 to 20 miles, with the total number of cows not less than from 400 to 500. A competent young man is employed to carry out the testing once a month at each farm, he being accommodated by the farmer over night. The association either provides the tester with a horse and trap to allow of his travelling from farm to farm, or arrangements are made by each farmer to take the tester to the next place. When the tester arrives he weighs the milk of each cow, takes a sample from it both night and morning, testing the samples on the farm and leaving a copy of the result with the farmer. His visit is made at about the same date in each month. At the end of the year he is enabled to give the farmer the production record sheet showing the yield of each cow in the herd. The financing of such associations is usually carried out by a fee of £1 per herd membership, and a levy of from 3s. to 5s. per cow per annum.

c. Pure breeds herd testing is conducted by officers of the Department of Agriculture who visit each stud once a month, see the cows milked out, weigh the milk, and take samples from all the cows under test over a period of 24

hours. The total butter fat for the day is computed and multiplied by 30 days. Such testing is conducted by this Department with the object of providing the dairy farmers of the State with the knowledge of where they can procure registered pure bulls ex dams with an official production. In this and the next issue of the *Journal*, under the heading "Herd Improvement," will be published a list of the particulars of all registered pure cows which have been officially tested, and exceeded the standard of production recommended by this Department for the use of bulls for general herd improvement.



Apparatus required to carry out milk testing.

Increased Herd Averages follow continued Herd Testing.—Herd testing all over the world leads to increased herd averages and efficiency in dairy farming. Invariably, as the result of the introduction of herd testing, an increased average production per cow is seen each successive year of the herd under test.

The following figures will be of interest in relation to the foregoing, showing the increased average production of cows under test in Western Australia:—

The averages of all cows under test in Western Australia during the years 1921, 1922, 1923, *and* 1924, *with allowances for juniors, are as follow*:—

Period 273 *days.*

Year.	Butter Fat per cow lbs.
1921	312·20
1922	342·34
1923	344·45
1924	399·64

A glance at the Scottish Milk Records Association's result will be of interest:—

Years	No. 1 Herd.		No. 2 Herd.		No. 3 Herd.	
	No. of Cows tested.	Percentage of Cows yielding more than 250lbs. fat.	No. of Cows tested.	Percentage of Cows yielding more than 250lbs. fat.	No. of Cows tested.	Percentage of Cows yielding more than 250lbs. fat.
1910	46	39	48	40	43	49
1911	42	64	52	56	39	54
1912	50	58	55	55	44	61
1913	52	77	56	79	38	89
1914	48	88	60	83	43	93
1915	53	80	53	82	39	97

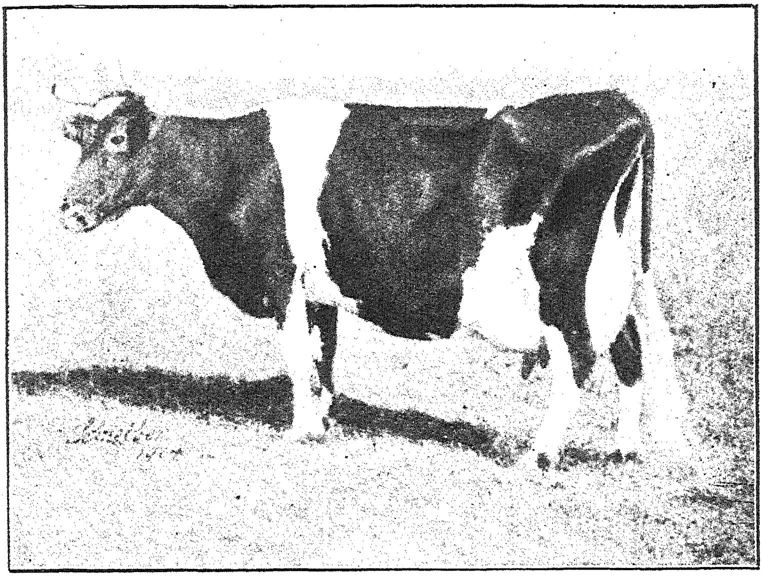
As an instance of the value of herd testing in herd improvement and progress in dariy farming, a brief report on the Monticello, Wisconsin, Cow Testing Association is worth quoting:—

"The Monticello, Wisconsin, Cow Testing Association is composed of 26 members, 17 of whom are breeders of registered pure cows. There are 823 cows on test. Each herd is headed by a registered pure bull. This year 12 members tested for T.B., making a total of 22 herds tuberculin tested. Each member has from one to four silos, totalling 50 wood stave, four hollow tile, two brick, and one cement stave. There are 15 barns equipped with modern all steel fixtures, nine with part steel and part wood swinging stanchions, and two with the old style wood fixtures. There are 23 barns equipped with drinking cups, seven had ventilation systems installed this year, making a total of 11. Nine bull pens and yards were built this year, making a total of 12. Twenty farms are equipped with electric lights. Each member has a modern milk house and cooling tank. All members operate their own farms, 22 sell their milk to condenseries, and four sell their milk to Swiss and Limburger cheese factories. Ten members use motor trucks to haul their milk.

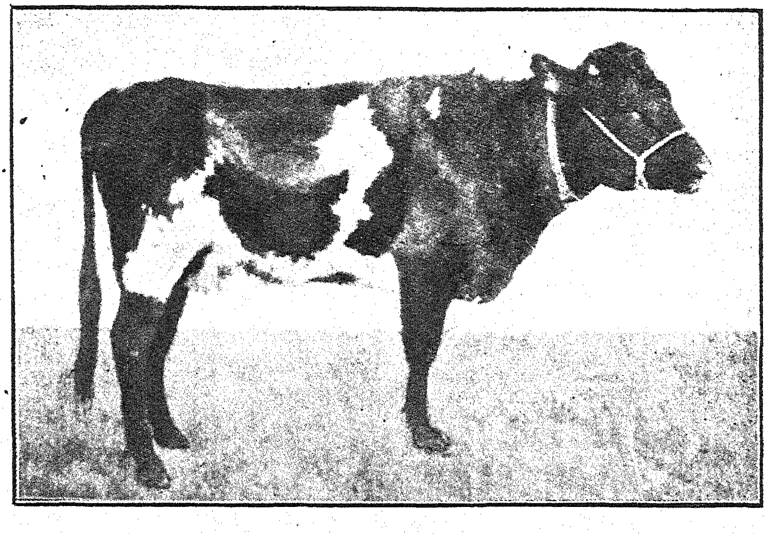
"The largest herd totals 164, including young stock, of which 62 are on test. The smallest herd totals 26 head, of which 19 are on test.

"Feed is bought co-operatively. Nineteen members are growing lucerne."

Herd Testing shows vast differences in Herd Averages.—In the September issue of this *Journal* was published the particulars of production, feed costs, and profits of herds under official test for the year ended 30th June, 1924. The best herd, which numbered 23 cows, showed 430.32lbs. fat as the average production of butter fat per cow for a nine months' lactation period. After making a deduction for the cost of feed per cow for the period (of which an accurate record was kept), there was a profit of £27 17s. 3d. per cow. The lowest producing herd under test yielded 198.34lbs. fat per cow,



The best cow. The "Star" Boarder.



The worst cow. A "non-paying" guest.

and, after making a deduction for cost of feeding, showed a profit of £11 13s. 3d. per cow. Between these two herds there was a difference of £16 4s. per cow. This means that a herd of 50 cows of the calibre of the leading herd would show a profit equal to £810 per annum greater than a herd of 50 cows similar to those of the worst herd.

Cow Testing at Busselton and Bunbury.—Some very interesting data has been obtained from the Herd Testing Competition which was conducted jointly by the Southern Districts Agricultural Society, Busselton, and the Department of Agriculture. The society gave prizes of £10, £5, and £1 for first, second, and third prizes respectively, for the best herd of 10 cows to be tested on farms surrounding the Busselton district over a 24-hour period. Nineteen farmers submitted their herds, and the results were taken for the best 10 cows of each herd. Altogether 327 cows were tested, and the records convey a very graphic illustration of the marked difference between one herd and another, the conditions as regards feeding being somewhat similar: the season being good and pastures plentiful.

Three hundred and twenty-seven cows tested, representing 19 herds. Best herd of 10 cows produced on a monthly basis 486lbs. of fat, and the worst herd of 10 cows 189lbs. of fat. The best cow produced 75lbs. of fat on a monthly basis as compared with 8lbs., as produced by the worst cow.

As will be noticed there is a marked difference between the best and worst herd and the best and worst cow.

The three lowest herds produced 699lbs. of fat for the month, and the three best 1,422lbs. of fat.

The data obtained in connection with the Herd Testing Competition conducted by officers of the Dairy Branch on behalf of the Wellington Agricultural Society, Bunbury, is also interesting. The competition was for the best herd of 10 cows, the herds being tested on their respective farms for a period of 24 hours. 11 herds were entered—12 cows each—best ten to count.

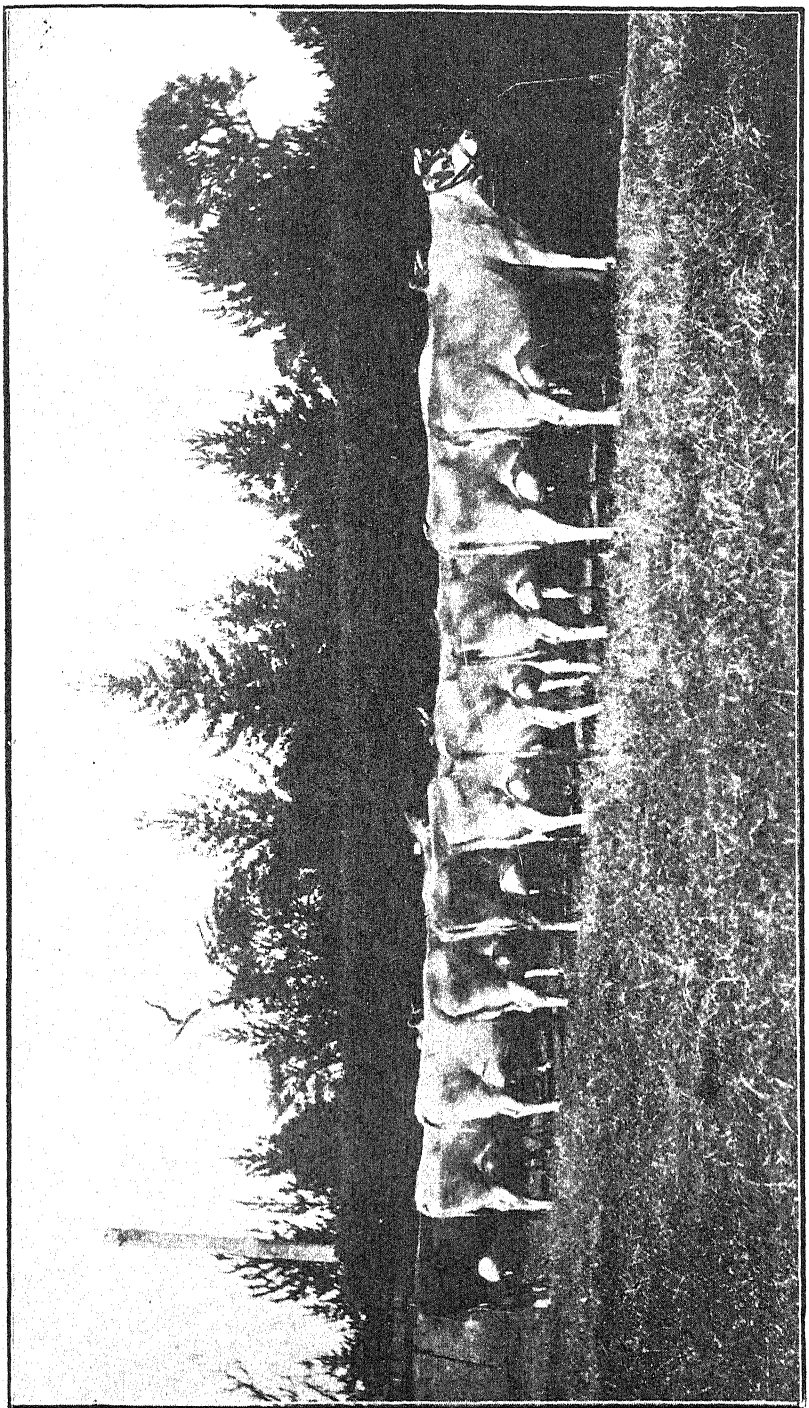
The best herd of ten cows averaged 44lbs. milk and 2.054lbs. butter fat per cow per day, equal to 635.0lbs. fat for one month from 10 cows.

The worst herd of ten cows averaged 16.15lbs. milk and .748lbs. butter fat per cow per day, equal to 231lbs. fat for one month from 10 cows.

The best cow produced 53lbs. milk, an average test of 5.99 per cent., equal to 3.178lbs. butter fat for 24 hours. This is equal to 3.734lbs. commercial butter for 24 hours; 26.13lbs. commercial butter for one week; and 112 lbs. commercial butter for one month.

The worst cow produced 19lbs. milk, an average test of 2.8 per cent., .533lbs. butter fat for 24 hours, .626lbs. commercial butter for 24 hours, equal to 4.382lbs. commercial butter for one week, or 18.78lbs. commercial butter for one month.

Single Test of Cows not reliable.—Whilst it is not desired, in any way, to advise against one test of a cow, it is pointed out that a single test as a guide is not reliable in assessing the cow's true worth. This aspect is quoted in view of the fact that buyers are often influenced by the fact that a cow is stated to have given, say, four gallons of milk testing five per cent., or that



The Winning Herd in the Bunbury Competition.

such and such a cow tests six per cent. A cow's test invariably increases in percentage of fat towards the end of the lactation period. A cow's test also varies, as a rule, between the morning and evening's milk, the evening's test generally being much higher than that of the morning, especially in the case where the intervals between the hours of the morning and evening milking are at much variance.

As an instance of how one may be deluded regarding the value of a cow on a single test, the production results of half a dozen cows which were under official test, are given:—

	Yield at First Month's Test, after calving.		Yield at Sixth Month's after calving.	
Cow No. 1 ...	40lbs Milk 1·916lbs. Fat	equal so 57·48lbs. Fat for 30 days. ...	9lbs. Milk ·555lbs. Fat	equal to 16·65lbs. Fat for 30 days.
Cow No. 2 ...	35lbs. Milk 2·057lbs. Fat	equal to 61·71lbs. Fat for 30 days. ...	8lbs. Milk ·484lbs. Fat	equal to 14·52lbs. Fat for 30 days.
Cow No. 3 ...	35lbs. Milk 1·430lbs Fat	equal to 42·90lbs. Fat for 30 days. ...	6lbs. Milk ·311lbs. Fat	equal to 9·33lbs. Fat for 30 days.
Cow No. 4 ...	31lbs. Milk ·955lbs. Fat	equal to 28·65lbs. Fat for 30 days. ...	8½lbs. Milk ·465 lbs. Fat	equal to 13·95lbs. Fat for 30 days.
Cow No. 5 ...	41lbs. Milk 1·636lbs. Fat	equal to 49·08lbs. Fat for 30 days. ...	8½lbs. Milk ·422lbs. Fat	equal to 12·66lbs. Fat for 30 days.
Cow No. 6 ...	31lbs. Milk 1·333lbs. Fat	equal to 39·99lbs. Fat for 30 days. ...	4lbs. Milk ·18lbs. Fat	equal to 5·4lbs. Fat for 30 days.

On examining the above figures, it will be noticed that cows, Nos. 1 and 2, stand out on their first month's test—after calving—as particularly high producers, and cows, Nos. 3 and 5, on their first month's test are also good producers. It will be seen, however, in comparing their yield at the sixth month after calving, that they are what are known by Herd Testing Associations to be "sprinters" and not "stayers." For instance, cow No. 1, which was yielding 57.48lbs. fat on her first month's test, dropped to 16.65lbs. fat at her sixth month, and cow No. 6, which was yielding 39.99lbs. fat on her first month's test, only produced 5.4lbs. fat at her sixth month's test.

Test Records at Sales.—Test records influence the sale of dairy stock very materially when owners have occasion to sell surplus stock, or in the case of a clearing out sale. It is now generally recognised by all thinking dairy farmers that, in purchasing dairy stock, the necessity of some guide as to the production of the animal being purchased or the production of its dam and sire's dam is essential. I have before me at the moment the catalogue of the Dispersal Sale of Mr. D. J. Goyder's Jersey cattle at Roelands Park, Roelands. The information contained regarding each animal offered, apart from the pedigree, supplies the production record of the animal offered or that of its dam and sire's dam, and in assisting buyers it is exceedingly valuable. As time goes on, purchasers of dairy stock will demand such records to accompany animals before they will purchase.

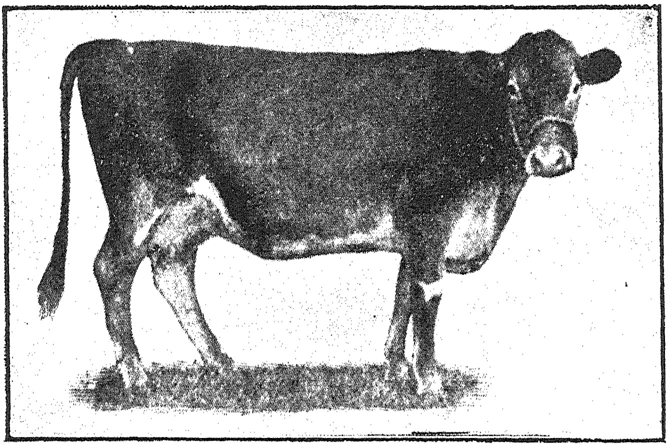
Conclusion.—The answer to low prices of dairy products and increased cost of production is increased unit or *average cow* production.

The use of the scales and the Babcock tester is the secret to profitable dairying.

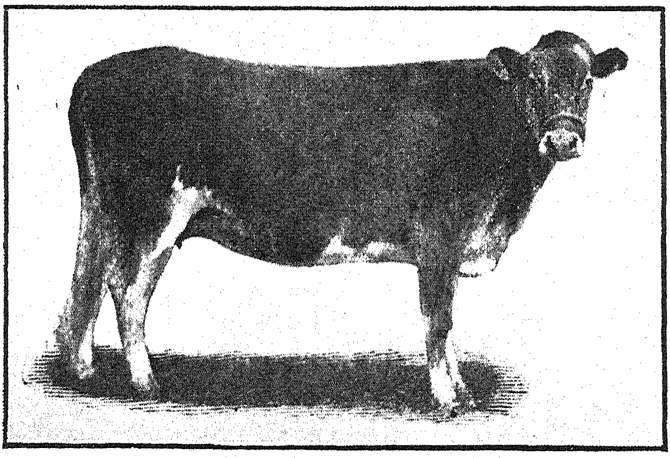
The dairyman's slogan in the development of his herd should be:—

"BREED," "FEED," "WEED."

THE DIFFERENCE IN COWS.



This cow produced 6,183lbs. of milk and 308.6lbs. of butter fat in 322 days.



This cow produced 2,730lbs. of milk and 143lbs. of butter fat in 291 days.

REPAIRING CONCRETE WALLS.

Usually when the inside of a concrete or other masonary silo is plastered the walls are not yet rigid. Subsequent checking and cracking often follow, and the owner wonders why, yet fails to take the time to repair them. Surface checks usually do no harm, and are often the result of excessive strain on the surface when the water evaporates. But if the checks are cracks and extend through the wall, they should be repaired. Pure cement wash is perhaps as good as anything. But to make the wash bond perfectly with the old concrete, the surface should be soaked with water for several minutes before the wash is applied. The wash should be of the consistency of thick cream first, then thickened until it will just pour. Large cracks which may require a flexible joint are repaired by heating with a blowtorch until the surrounding surface is warm. Asphalt-soaked rags are then tamped in with a hammer and a hardwood stick, and then covered with pure asphalt or heavy tar. These hints will apply also to cisterns or water tanks.—"Country Gentleman."

DAIRY HERD IMPROVEMENT.

P. G. HAMPSHIRE,
Dairy Expert.

List of registered pure cows which have been officially tested and exceed the required production, enabling their male progeny to be eligible for purchase by the Government with the view of improving the dairy herds of Western Australia.

Following upon the Department's policy of urging the use of registered pure sires ex dams with official butter fat production of such merit as will enable the progeny of these cows to be the means of improving the progeny of the average production cows of the State, the following is a list of all standard cows which have been officially tested to date. When the scheme for dividing the State into zones for the use of registered pure bulls ex these proved production cows was launched, it was noted the success of such a scheme would depend upon continuity of policy, and following on the use of the male progeny of standard cows it is confidently expected that material advance will be made in the production of the average cow in each of the zones through their progeny.

The Government has laid down that the only bulls that will be purchased for distribution to group settlers and others must be the progeny of cows with a production record above the standard decided upon. The information shown in this and the next issue of the *Journal* gives the name of owner, name of cow, breed, herd book number, weight of milk for period, average test, total butter-fat and standard required—lbs. of fat. In confirmation of circular issued on 29th May, 1924, the standard of production over a period of 273 days' test is 166 lbs. fat (or 200 lbs. commercial butter) in the case of a heifer on first calf, 207 lbs. fat (or 250 lbs. commercial butter) in the case of a cow under four years, and 249 lbs. fat (or 300 lbs. commercial butter) in the case of a mature cow.

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Collingwoods Gladys	D. J. Goyder...	Jersey ...	5,909	4,224	5·43	232·23	166
Brighton Queen III. of St. Lambert	do. ...	do. ...	5,292	4,719	5·01	240·18	166
Retford Buttercup II.	do. ...	do. ...	6,830	4,059	6·56	266·50	166
Jean of Dardanup	do. ...	do. ...	9,989	5,108	4·60	235·10	166
Lyracleas Favourite	do. ...	do. ...	6,823	7,397	5·04	373·06	166
Lulu of Tellaraga	do. ...	do. ...	4,793	6,988	4·82	336·95	249
Island Cream of Roelands ...	do. ...	do. ...	6,822	5,417	5·89	319·48	166
Jean II. of Dardanup	R. H. Rose ...	do. ...	8,475	6,598	4·22	281·20	249
Obligato	D. J. Goyder	do. ...	4,964	5,989	5·10	305·56	249
Lily II. of Dardanup	R. H. Rose ...	do. ...	8,946	5,599	5·22	292·47	166
Daisy of Grassvale	do. ...	do. ...	8,473	4,822	5·36	258·55	207
Mokine Empire's Lily III. ...	T. H. Wilding	do. ...	10,049	6,206	5·75	357·35	249
Mokine Orange Lily	do. ...	do. ...	10,014	4,849	5·88	285·47	249
Romany Maid of Tarnfirr ...	P. Rose ...	do. ...	6,036	5,274	5·48	289·39	207
Maitland Zingara	D. J. Goyder...	do. ...	3,086	6,334	5·15	325·98	249
Carnation of Dardanup ...	R. H. Rose ...	do. ...	9,995	4,767	5·25	250·62	166
Jessie of Dardanup	do. ...	do. ...	8,945	5,456	5·00	277·23	166
Noreena of Tellaraga	D. J. Goyder	do. ...	6,828	4,753	5·19	246·61	166
Pansy III. of Penryn	do. ...	do. ...	5,192	5,974	5·59	333·90	249
Pretty Maid of Roelands ...	do. ...	do. ...	5,911	6,239	4·44	277·92	249
Noreen 5th, of Banyule ...	W. Padbury ...	do. ...	7,125	3,644	5·64	205·51	166
Mokine Lady Guildford III. ...	T. H. Wilding	do. ...	10,634	5,366	5·92	317·89	249
Jean of Dardanup	D. J. Goyder	do. ...	9,989	4,805	4·56	219·24	207
Lydia 5th of Yaralla	do. ...	do. ...	6,826	4,392	4·84	212·92	166
Beauty 3rd, Wangara of Pine Hill	R. H. Rose ...	do. ...	6,134	5,562	4·89	272·40	207
Antimony's Elvira	T. L. Rose ...	do. ...	8,465	5,655	5·31	300·27	249
Luxe of Yarralla	D. . Goyder	do. ...	6,825	6,599	4·65	306·96	207
Morden Lady V., of Waterville	A. W. Padbury	Guernsey	130	9,680	4·42	428·26	249
Yarraview Silver Susan ...	do. ...	do. ...	406	6,274	4·94	310·24	249
Yarraview Isabel	do. ...	do. ...	397	4,929	5·15	254·21	207
Topsy of Grassvale	R. H. Rose ...	Jersey ...	10,101	6,205	5·51	348·63	249
Lyracleas Favourite	D. J. Goyder	do. ...	6,823	7,173	5·24	376·18	207
Retford Buttercup II.	do. ...	do. ...	6,830	4,856	6·08	295·37	207
Island Cream of Roelands ...	do. ...	do. ...	6,822	4,797	5·40	258·84	207
Daisy of Grassvale	R. H. Rose ...	do. ...	8,473	4,687	5·69	266·94	249
Carnation of Dardanup ...	R. H. Rose ...	do. ...	9,995	4,930	5·20	256·47	207
Jessie of Dardanup	do. ...	do. ...	8,945	5,056	4·83	244·36	207
Lady Mints Gem	W. Padbury ...	do. ...	8,459	5,034	5·61	282·84	249
Brightlass of Woollingurry ...	D. J. Goyder	do. ...	6,818	7,540	5·05	380·62	207
Yarraview Junket	A. W. Padbury	Guernsey	399	5,531	5·15	285·05	249
Gaylass of Koojan	do. ...	do. ...	630	4,502	5·68	255·91	166
Lily II. of Dardanup	R. H. Rose ...	Jersey ...	8,946	6,173	5·06	312·43	207
Lady Betty II. of Koojan ...	A. W. Padbury	Guernsey	N.Y.A.	6,542	4·47	292·88	207
Favourite of Roelands	D. J. Goyder ...	Jersey ...	6,819	4,740	5·15	244·17	166
Daisy 6th of Melrose	W. Padbury ...	do. ...	4,512	7,240	5·19	375·17	249
Lady Mints Gem	do. ...	do. ...	8,459	5,148	5·64	290·67	249
Fondant 9th of Garden Hill ...	do. ...	do. ...	8,456	4,727	5·61	265·31	207
Yarraview Bonnie Annie ...	A. W. Padbury	Guernsey	564	6,665	6·27	418·20	207
Noraleda	D. J. Goyder	Jersey ...	4,794	6,546	4·77	312·19	249
Noreena of Tellaraga	do. ...	do. ...	6,828	6,468	5·34	345·49	207
Carlotta of Ventrim	T. L. Rose ...	do. ...	8,467	5,939	5·36	318·29	207
Magnolia III., of Southbridge...	R. H. Rose ...	do. ...	7,287	3,755	6·24	234·52	207
Maitland Zingara	D. J. Goyder...	do. ...	3,086	7,092	4·99	353·32	249
Jean of Dardanup	do. ...	do. ...	9,989	5,502	4·47	245·97	207
Fancy of Ventonia	T. L. Rose ...	do. ...	8,648	7,590	6·07	461·05	249
Antimony's Elvira	do. ...	do. ...	8,465	7,313	5·36	391·91	249
Lydia 5th of Yarralla	D. J. Goyder...	do. ...	6,826	6,274	5·44	341·63	207
Veronica of Tarnfirr	do. ...	do. ...	5,174	6,330	4·65	294·29	249
Noble Lass 2nd of Yaralla ...	do. ...	do. ...	6,825	4,989	5·39	268·93	207
Rhodesia 5th of Penryn ...	T. L. Rose ...	do. ...	8,470	7,497	4·51	338·45	249
Jean 2nd of Dardanup ...	R. H. Rose ...	do. ...	8,475	6,035	4·33	261·73	249
Beauty 3rd Wangarra of Pine Hill	do. ...	do. ...	6,134	6,345	4·42	280·54	249
Milkmaid of Grassvale	do. ...	do. ...	8,472	4,422	4·78	211·62	166
Maranora of Tellarraga ...	do. ...	do. ...	6,707	6,297	4·93	310·66	249
Lyracleas Favourite	D. J. Goyder	do. ...	6,823	8,925	5·28	472·09	249
Fondant 3rd of Garden Hill ...	W. Padbury ...	do. ...	7,224	7,821	5·34	418·28	249
Wild Rose 2nd of Garden Hill	do. ...	do. ...	10,091	5,519	5·70	314·78	249
Rhodora IV.	D. Malcolm ...	do. ...	4,763	6,447	5·27	339·95	249
Madge of Dalebank	do. ...	do. ...	4,759	5,822	5·83	339·73	249
Queen of Roelands	do. ...	do. ...	6,829	5,273	4·87	256·67	166
Milton's Rosebud	A. W. Padbury	Guernsey	500	4,986	4·71	239·93	166
Obligato	D. J. Goyder...	Jersey ...	4,964	6,168	4·79	295·45	249
Milton's Syringa	A. W. Padbury	Guernsey	503	3,617	5·84	211·34	166
Lady Fowler V. of Dardanup ...	T. L. Rose ...	Jersey ...	9,990	5,591	4·96	277·38	249
Lady Mint's Gem II.	W. Padbury ...	do. ...	8,460	4,338	5·44	236·17	166
Daisy of Grassvale	R. H. Rose ...	do. ...	8,473	5,529	5·66	313·13	249
Yarraview Glaydes	A. W. Padbury	Guernsey	783	3,605	5·77	208·18	166
Morden Lady V. of Waterville	do. ...	do. ...	130	9,363	4·09	382·96	249

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Mayflower of Koogan	A. W. Padbury	Ouernsey	679	3,751	5·93	222·46	207
Icecream of Glen Iris	W. Padbury ...	Jersey ...	7,110	4,000	5·31	212·48	166
Lulumar of Tellarraga	R. H. Rose ...	do. ...	6,706	5,723	4·82	276·19	249
Jessie of Dardanup	do. ...	do. ...	8,945	5,141	4·87	250·42	249
Creamy of Dardanup	do. ...	do. ...	8,941	4,816	5·64	271·61	249
Yarraview Silver Susan ...	A. W. Padbury	Guernsey	406	5,436	4·71	256·54	249
Fairy of Dardanup	R. H. Rose ...	Jersey ...	8,942	7,655	4·46	342·08	207
Lady Fowler of Roelands ...	D. J. Goyder	do. ...	9,991	5,811	5·30	308·35	249
Brightlass of Wollingurry ...	do. ...	do. ...	6,818	7,846	5·58	438·36	249
Modest 2nd of Homeleigh ...	D. Malcolm ...	I.M.S. ...	Vol. 2	5,099	3·96	202·20	166
Girlie of Sarnia	do. ...	Jersey ...	9,992	9,038	4·78	432·78	207
Flavoria of Banyule	Dept. of Agriculture	do. ...	8,489	5,315	5·80	308·57	249
Yarraview Georgina	A. W. Padbury	Guernsey	782	4,604	5·34	246·25	166
May of Grassvale	R. H. Rose ...	Jersey	9,997	3,839	5·34	205·07	166
Jean 2nd of Grassvale	do. ...	do. ...	9,996	4,329	5·90	255·43	166
Twylish Madeira of Roelands ...	D. Malcolm ...	do. ...	6,832	3,918	5·90	231·23	166
Lady Betty 2nd of Koogan ...	A. W. Padbury	Guernsey	N.Y.A.	5,717	4·65	266·14	249
Gay Lass of Koogan	do. ...	do. ...	630	4,516	6·15	277·19	207
Retford Buttercup 2nd ...	D. J. Goyder...	Jersey ...	6,830	7,488	6·50	487·25	249
Mystery 20th of Melrose ...	D. Malcolm ...	do. ...	8,450	6,610	6·34	419·55	249
Jessimia XI. of King's Vale ...	do. ...	do. ...	6,339	6,008	4·51	271·01	249
Daisy of Garden Hill	W. Padbury ...	do. ...	10,628	3,597	6·06	218·02	166
Yarraview Bonnie Annie ...	A. W. Padbury	Guernsey	564	6,189	6·33	392·01	249
Wisteria 2nd of Homeleigh ...	D. Malcolm ...	I.M.S. ...	Vol. 2	6,769	4·47	303·09	166
Rhodora IV.	do. ...	Jersey ...	4,763	9,746	5·38	524·54	249
Maranora of Tellaraga	R. H. Rose ...	do. ...	6,707	9,081	4·74	430·40	249
Rhodora 2nd of Dalebank ...	D. Malcolm ...	Jersey ...	8,451	5,111	5·82	297·52	166
Jean 2nd of Dardanup ...	R. H. Rose ...	do. ...	8,475	8,304	4·20	349·27	249
Fondant 6th of Garden Hill ...	W. Padbury ...	do. ...	8,455	4,484	5·81	260·60	249
Obligato	D. J. Goyder	do. ...	4,964	6,200	5·11	318·99	249
Lydia 5th of Yarralla	do. ...	do. ...	6,826	6,453	5·32	343·47	249
Madge 2nd of Dalebank ...	D. Malcolm ...	do. ...	8,449	4,536	5·56	252·31	166
Daisy of Grassvale	R. H. Rose ...	do. ...	8,473	7,690	5·37	413·56	249
Noreen of Garden Hill ...	W. Padbury ...	do. ...	11,662	3,218	5·48	176·36	166
Morden Lady of Koogan ...	A. W. Padbury	Guernsey	722	7,473	3·83	286·46	166
Shiela of Sarnia	D. Malcolm ...	Jersey ...	8,452	6,178	5·70	352·46	166
Milton's Rosebud	A. W. Padbury	Guernsey	500	6,048	4·27	258·25	207
Buttercup of Roelands ...	D. J. Goyder	Jersey ...	10,616	3,528	5·71	201·56	166
Retford Wonder 2nd	D. Malcolm ...	do. ...	4,435	6,195	6·25	387·18	249
Noble Jessie IV. of Banyule ...	Department of Agriculture	do. ...	8,490	4,431	5·29	234·79	207
Wild Rose 2nd of Garden Hill	W. Padbury ...	do. ...	10,091	7,464	5·92	441·96	249
Icecream of Glen Iris	do. ...	do. ...	7,110	4,674	5·48	256·21	207
Lulu 2nd of Roelands	D. J. Goyder...	do. ...	10,614	4,531	4·77	216·52	166
Beauty 3rd, Wangara of Pine Hill	R. H. Rose ...	do. ...	6,134	6,885	4·37	300·84	249
Queen of Roelands	D. Malcolm ...	do. ...	6,829	4,836	4·92	238·02	207
Yarraview Glaydes	A. W. Padbury	Guernsey	783	5,022	5·01	251·76	207
Milton's Syringa	do. ...	do. ...	503	4,095	5·69	233·07	207
Lux of Yarralla	D. J. Goyder...	Jersey ...	6,825	8,376	4·61	386·76	249
Lydia of Roelands	do. ...	do. ...	11,431	4,566	4·94	225·99	166
Retford Tessie	W. Padbury ...	do. ...	8,464	3,577	5·91	211·42	207
Jean of Grassvale	R. H. Rose ...	do. ...	8,476	4,880	4·64	226·75	207
Carnation of Dardanup ...	do. ...	do. ...	9,995	8,870	5·35	474·87	249
Jessie of Dardanup	do. ...	do. ...	8,945	7,434	5·07	377·04	249
Lyracleas Favourite	D. J. Goyder	do. ...	6,823	11,462	5·01	574·23	249
Clematis of Gleniris	W. Padbury ...	do. ...	7,108	6,042	5·91	357·16	249
Treasure 3rd of Homeleigh ...	D. Malcolm ...	M.S. ...	Vol. 2	8,805	4·34	382·87	166
Golden Cream of Roelands ...	D. J. Goyder...	Jersey ...	10,617	4,860	5·19	252·27	166
Boronia of Grassvale	R. H. Rose ...	do. ...	9,994	6,675	4·94	330·07	207
Lily 2nd of Dardanup	do. ...	do. ...	8,946	7,933	4·92	390·16	249
Creamy of Dardanup	do. ...	do. ...	8,941	6,197	4·99	309·44	249
Silver Belle of Roelands ...	A. H. Henning	do. ...	10,047	5,820	4·62	269·32	249
Fondant 3rd of Garden Hill ...	W. Padbury ...	do. ...	7,224	9,037	5·52	499·64	249
Lady Fowler 2nd of Dardanup	R. H. Rose ...	do. ...	10,003	6,252	4·65	290·63	249
Lady of Inglewood	D. Malcolm ...	do. ...	5,910	5,898	5·62	331·46	249
Girlie 2nd of Sarnia	do. ...	Jersey ...	11,633	7,140	4·13	295·36	166
Lily of Roelands	D. J. Goyder...	do. ...	10,619	4,881	4·43	216·64	166
Fairy of Dardanup	R. H. Rose ...	do. ...	8,942	8,305	4·75	395·05	249
Mamselle Mimi of Hamel Lea...	A. H. Henning	do. ...	10,046	5,166	5·37	277·85	207
Brightlass of Wollingurry ...	D. J. Goyder	do. ...	6,818	11,289	4·93	556·74	249
Lily of Grassvale	R. H. Rose ...	do. ...	8,947	7,482	5·00	374·63	166
Pet 8th of Glenira	D. Malcolm ...	M.S. ...	...	5,802	4·67	270·98	166
Retford Violet	W. Padbury ...	Jersey ...	6,938	6,528	5·78	348·08	249
Favourite of Roelands	D. J. Goyder...	do. ...	6,819	7,697	5·02	396·37	207
Morden Lady V. of Waterville	A. W. Padbury	Guernsey	130	10,290	4·24	437·21	249
Lady Fowler 12th of Dardanup	R. H. Rose ...	Jersey ...	10,011	6,970	4·75	332·25	166
Pride III. of Black Heath ...	Wooroloo Sanatorium	M.S. ...	N.Y.A.	7,049	3·73	263·52	166

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Milton's Daisy	A. W. Padbury	Guernsey	N.Y.A.	5,515	5·47	278·37	166
Picton's Trequean Flirt ...	do. ...	do. ...	747	5,566	4·74	264·20	166
Mokine Empire's Lily VI. ...	T. H. Wilding	Jersey ...	10,636	6,120	6·19	380·57	166
Gladys of Roelands	D. J. Goyder...	do. ...	6,821	5,763	5·53	318·93	207
Daisy VI. of Melrose	W. Padbury ...	do. ...	4,512	10,605	5·18	550·05	249
Wisteria 2nd of Homeleigh ...	D. Malcolm ...	I.M.S. ...	N.Y.A.	6,184	3·94	243·85	207
Jean II. of Grassvale	R. H. Rose ...	Jersey	9,996	8,701	5·84	508·93	207
Cocky of Claremont	Hospital for Insane	M.S. ...	N.Y.A.	10,296	4·02	414·25	249
May of Blackheath	Wooroloo Sanatorium	do. ...	N.Y.A.	10,065	3·84	386·56	166
Maranora of Tellarraga ...	R. H. Rose ...	Jersey	6,707	10,533	5·05	531·90	249
Dorinda 4th of Dardanup ...	P. Rose ...	do. ...	9,993	5,713	5·50	314·38	249
Blossom of Moorlands	do. ...	do. ...	8,926	4,476	5·27	236·20	166
Lass of Moorlands	do. ...	do. ...	8,939	4,917	5·44	284·81	207
Myrtle of Merridale	do. ...	do. ...	8,928	4,828	5·44	262·85	249
Overton Mary	W. G. Burgess	Ayrshire	2,601	7,994	4·38	350·51	249
Marge of Oakbank	do. ...	do. ...	6,161	6,043	4·41	266·52	249
Tipperary Mona	do. ...	do. ...	6,165	6,568	4·88	320·58	249
Fuchsia of Gleneira	do. ...	do. ...	8,514	6,813	4·52	307·89	166
Quality of Oakbank	do. ...	do. ...	6,163	7,042	3·70	260·87	249
Winifred of Oakbank	do. ...	do. ...	6,167	8,475	4·02	341·07	249

(*List continued next issue of "Journal."*)

FLAX CULTIVATION.

Australia's Opportunity.

That the excellent prices being realised for flax and the great shortage of this fibre represents a unique opportunity for establishing this valuable industry in Australia is the opinion of Mr. F. Strachan, an expert on this question, who is endeavouring to arouse interest in flax growing. He is at present in Riverina for that purpose.

Prior to the war, states Mr. Strachan, flax fibre brought £80 per ton, and cotton £40. Now cotton was £120, and flax realised an average of £180. An excellent flax plot was grown at Eden (New South Wales) last year by a farmer named Wellings. Sown in May, it was harvested in December. A succession of frosts, some very heavy, attended it until September. Its height was 31 inches. The fibre was equal to the Irish, and was valued at £180. The linseed was equal to the best Victorian, fetching at present £22 per ton. The shortage of flax fibre in the European markets was equal to the whole of the Australian wool export, over 2,000,000 bales. At an average price of, say, even £130, the value of this flax shortage would be £40,000,000. In the Geelong district of Victoria a start had been made by private enterprise. This year 260 acres were being harvested and treated at a small mill. A company had been formed to promote the industry in that part of Victoria. An average of two tons of flax hay was obtained by the growers. Several acres averaged 2½ tons, and one of five acres was reported at the time of his recent inspection to have reached 3½ tons per acre. The price given by the miller for the hay was £5 per ton, equal to about 33 bushels of wheat at 6s. It must be pointed out, however, that with improved, up-to-date machinery an even higher price would be paid growers.

HERD TESTING.

WESTERN AUSTRALIAN OFFICIAL HERD TESTING RESULTS FOR QUARTER ENDING FEBRUARY, 1925.

Conducted by Officers of Dairy Branch.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age at beginning of Test. Yrs.	Mths.	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.	Remarks.
MATURE COWS—STANDARD REQUIRED 350 LBS. OF BUTTER FAT—273 DAYS.												
								lbs.	%	lbs.	lbs.	
Maranora of Tellegara	R. H. Rose ...	Jersey ...	6707	7	2	16-5-24	273	11,509	5·04	580·48	26½	
Fairy of Dardanup	do.	do. ...	8942	6	4	20-5-24	273	11,235	4·80	539·41	30	
SENIOR 4 YEARS OLD (OVER 4½ YEARS AND UNDER 5 YEARS)—STANDARD 325 LBS. BUTTER FAT.												
Bolebek Judith	A. L. B. Lefroy ...	Friesian ...	291	4	9	23-5-24	273	14,164	3·16	448·72	36½	
Bolebek Dorothea	do. ...	do. ...	293	4	9	14-4-24	273	7,306	3·78	276·88	15½	
JUNIOR 4 YEARS OLD (OVER 4 YEARS AND UNDER 4½ YEARS)—STANDARD 300 LBS. OF BUTTER FAT.												
Lady Fobes Veeman	A. L. B. Lefroy ...	Friesian ...	U.S.A. 620852	4	5	11-4-24	273	16,533	3·17	524·88	46	
Bolebek Frieda	do.	do. ...	1116	4	1	17-2-24	273	8,664	3·50	303·79	23	
SENIOR 3 YEARS OLD (OVER 3½ YEARS AND UNDER 4 YEARS)—STANDARD 275 LBS. OF BUTTER FAT.												
Bolebek Dulcina	A. L. B. Lefroy ...	Friesian ...	1120	3	9	26-4-24	273	8,475	3·62	307·16	25	
JUNIOR 3 YEARS OLD (OVER 3 YEARS AND UNDER 3½ YEARS)—STANDARD 250 LBS. OF BUTTER FAT.												
Bolebek Roma	A. L. B. Lefroy ...	Friesian ...	1124	3	4	7-4-24	273	8,286	3·75	310·91	22	
SENIOR HEIFERS (UNDER 3 YEARS AND OVER 2½ YEARS)—STANDARD 225 LBS. OF BUTTER FAT.												
Milton's Dulcie II.	A. W. Padbury ...	Guernsey	928	2	8	14-4-24	273	8,571	5·06	433·93	27	
Beauty of Sarnia	D. Malcolm ...	Jersey ...	12086	2	9	3-5-24	273	2,325	5·61	130·55	5	
JUNIOR HEIFERS (UNDER 2½ YEARS)—STANDARD 200 LBS. OF BUTTER FAT.												
Mokine Clove Carnation ...	Mesdames Walker & Co.	Jersey ...	11796	2	5	2-4-24	273	4,779	6·70	320·52	13	
Myrtle 12th of Greyleigh ...	D. Malcolm ...	M.S. ...	N.Y.A.	2	3	26-4-24	273	4,557	4·04	184·49	4	

REGULATIONS UNDER "THE STOCK DISEASES ACT, 1895."

Compulsory Dipping Area.

South-West Division of the State South of the Eastern Railway.

32. (a) Every owner of sheep within the boundaries of that part of the South-West Division South of the Eastern Railway shall after the shearing of such sheep and before the 30th day of April in each year, dip or cause to be dipped, in a swim bath prepared with some specific known to be fatal to ticks and lice, all sheep running on land whereof he is the owner or occupier.

(c) For every sheep not dipped as provided in this regulation, within the period prescribed above, the owner shall be liable to a fine not exceeding two shillings.

South-West Division of the State North of the Eastern Railway.

32. (b) Every owner of sheep within the boundaries of that part of the South-West Division North of the Eastern Railway shall, after the shearing of such sheep and before the 28th February in each year, dip or cause to be dipped, in a swim bath prepared with some specific known to be fatal to ticks and lice, all sheep running on land whereof he is the owner or occupier.

Ewes with lambs—time for dipping.

33. Nothwithstanding anything contained in these regulations, it shall not be necessary to dip ewes affected with ticks or lice during such time previous to or after their lambing as the inspectors may appoint, and for such purpose any inspector may, in respect of such ewes, extend any notice to dip for such time as he shall think fit.

Statutory Declaration to be supplied within seven days after dipping.

34. Within seven days after the dipping of his sheep the owner shall make a statutory declaration before a justice of the peace, to the effect of Schedule 5a hereto, stating that he has dipped his sheep in accordance with the provisions of these regulations, the date of dipping, the number of sheep dipped, and the class of dip used, and he shall forward such declaration to the police officer in charge of the police station nearest to him. Such declaration shall be forwarded by the said police officer to the Chief Inspector of Stock.

Permits to move sheep in the Gascoyne.

Every owner of sheep in the area defined in the Schedule hereto must, before travelling or removing or causing to be removed, or attempting to remove, any sheep to any place outside the said area, obtain a permit to remove such sheep from an inspector of stock, who shall not issue the said permit unless he is satisfied that the sheep intended to be so removed out of

the prescribed area are free from parasites known as tick and lice; and every person contravening this regulation by act or omission shall be punishable summarily, and upon conviction be liable to a penalty not exceeding one hundred pounds and not less than fifty pounds.

Schedule.

That portion of the State bounded on the South by the Northern boundary of the South-West Division, commencing at the sea-coast and proceeding as far as the intersection of such boundary with the 115.5 meridian of longitude; thence following such meridian Northerly to the intersection of the sea-coast; thence along the sea-coast to the starting point.

Lice or tick-infested sheep in any part of the State.

36. (a) If an inspector is satisfied that a flock depasturing in any part of the State is affected with tick or lice, he shall give the owner thereof notice to dip such stock forthwith to the satisfaction of the inspector or his agent.

Provided that the owner who refuses, neglects, or fails to comply with such notice on or before the date specified therein shall be liable on conviction to a penalty not exceeding fifty pounds for the first offence, and if immediately after conviction for the first offence such sheep shall not be dipped to the entire satisfaction of the inspector, such owner shall upon conviction be liable to a further penalty not exceeding fifty pounds, and so on for each and every succeeding conviction.

Tick or lice on sheep exposed in a public market or exhibited for show purposes or any other place where offered for sale.

36. (b) If any sheep affected with tick or lice shall be found in any pound, or in any yard or yards, or on any land or other place at which sheep are offered for sale or exhibited for show purposes, the owner exposing the sheep so affected shall be liable to a penalty not exceeding fifty pounds: Provided that any inspector, if he deems it necessary, may order the withdrawal from sale of any sheep affected with ticks or lice until such sheep have been dipped or dressed to the satisfaction of such inspector or any other inspector, and shall give notice to the aforesaid owner of such sheep to dip or dress the same forthwith, at such place as the inspector may direct; and every such owner who refuses, neglects, or fails to comply with the aforesaid notice is liable to a further penalty not exceeding twenty pounds. But if the inspector is satisfied that such sheep are intended for immediate slaughter, he may withhold such notice to dip.

CLUSTER CLOVER.

(*Trifolium glomeratum.*)

W. M. CARNE and C. A. GARDNER, Botanical Branch, and
A. B. ADAMS, Dipl. Agric., Agricultural Adviser.

Cluster clover is one of the most useful of the annual pasture plants in this State. It is widely distributed, and amongst the clovers is probably next to Subterranean in importance. It occurs more or less plentifully throughout the well watered South-West, especially on the better drained soils. It does not thrive on wet soils. In the drier areas it is superior to Subterranean Clover, as it will grow and produce seed under conditions that are generally too dry for the latter. Where both thrive Subterranean Clover must be regarded as the better plant, as it is more vigorous and produces a greater bulk of feed.

Cluster clover will probably succeed as far East as Kellerberrin, but it cannot be expected to thrive in drier areas.

In common with most of our leguminous pasture plants, Cluster Clover responds well to topdressing with superphosphate. Without the presence of phosphatic fertilisers it may live and seed, but the plants are usually so small as to be barely noticeable. Following topdessing the clover grows vigorously and produces quantities of seed. In many cases 30 cwts. of clover hay may be obtained from an acre.

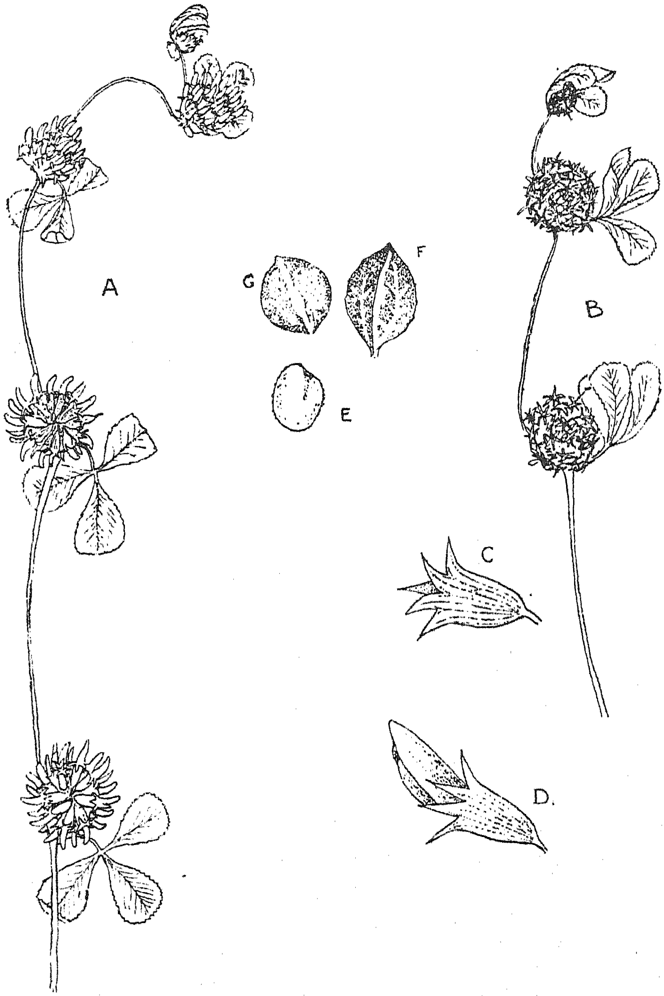
Unlike Burr Clover (*Medicago denticulata*) Cluster Clover seeds well even when heavily stocked with sheep. For this reason, together with the fact that a large proportion of the seeds are hard shelled, once it is established on suitable land it is extremely unlikely to die out.

Cluster clover is very nutritious and palatable for all classes of stock. As the seed heads are not spiny the seed is not distributed as readily by stock as Burr Clover, but nevertheless stock do spread the seed through their droppings and by carrying the seed heads. At the same time the absence of spines on the seed heads prevents them becoming a nuisance in wool.

This clover has one disadvantage. Although it germinates with the first rains in the autumn, it does not make much growth until the weather starts to warm up in the spring.

Being such a useful plant it will pay the farmer to introduce it on his farm if it is not already growing there. The seed is cheap, and being very small a few pounds sown over a burn or with a crop will give a stand over a good area. Once it is established it can be helped to spread by sweeping up the seed and sowing on fresh land, as although it will eventually be carried by stock it will spread much more rapidly with a little help.

The seed is very small, about 1,500,000 going to the pound. The percentage of hard seeds is very high, ranging from 65 per cent. to 94 per cent. in three samples examined. The immediate germination of these three samples varied from four per cent. to 20 per cent. The hard seeds can be relied upon to germinate during following seasons and especially after a fire. Seed may be purchased at about 1s. 3d. per lb. This seed comes from New Zealand.



CLUSTER CLOVER

(*Trifolium glomeratum*).

Explanation—A. Flowering branch. B. Seeding branch. C. Calyx (enlarged). D. Flower (enlarged). E. Clover seed. F. Sorrel seed. G. Sorrell seed with husk removed.

It is very variable in quality, and many contain large quantities of other seeds up to 1/3rd of its weight. Many of these seeds are of other clovers and grasses, and are not objectionable. Some samples, however, contain large quantities of sorrel seeds (see plate), and should be avoided.

Sorrel may be recognised as small dark brown seeds slightly larger and readily distinguishable from the light yellow seeds of the clover. They are triangular in cross section with a smooth shining surface, but usually appear dull and rough owing to the presence of a shrivelled husk.

Description.—A hairless annual, with spreading prostrate stems, or when occurring densely more erect. Leaflets three, obovate, obtuse at the apex, finely toothed in the upper parts. Stipules (at the base of the leaves) more or less triangular and long-pointed.

Flowers pink in globular heads without any common stalk, situated at the base of the leaves or at the ends of the branches, the heads usually distant from each other.

Calyx 10-nerved, with short broad teeth spreading or erect in flower, but rigidly bent backwards as the pod ripens. Corolla pink, longer than the calyx, but narrow. Pod enclosed in the calyx, 1-2 seeded. Seeds small, light yellow, almost globular, rough and not shining.

Native of Mediterranean Region and Western Europe.

LOCUSTS.

L. J. NEWMAN, Entomologist.

The advent of summer rains throughout the locust-infested areas has created conditions which make it possible to break up the soil. Advantage should therefore be taken by farmers who are in the infested districts to immediately get to work and break up those areas which they know to contain the locust eggs. The land should not be ploughed too deeply (2½ to 3 inches being sufficient), as this would simply turn the egg tubes over without breaking them.

After ploughing thoroughly work the soil to break up the lumps and expose the tubes and eggs. By so doing, the elements, birds, and insect parasites are enabled to gain access to the eggs, and thus they are destroyed.

The opportunity now presented should not be missed, as it will mean the saving of much labour, damage, and expense later on.

CONCERNING FOXES.

C. J. CRAIG,
Chief Inspector of Rabbits.

Now that the fox has followed the example of the rabbit, and journeyed West, the following information may prove of interest:—Strangely enough, although odd foxes have been killed in widely separated portions of the State, it is only in the belt of country extending from above Northampton to Geraldton and Mingenew that they are at all numerous. However high a standard the cunning of the fox may have traditionally attained in other directions, in the matter of devouring poison baits its reputation suffers greatly; it is much easier to poison than the dingo, and can rarely resist baits of liver, kidney, kidney fat, and, best of all, birds. The method of preparing the latter is to hold the beak open of a freshly shot parrot or galah and insert a sharp penknife down the throat, cutting the palate and throat slightly. As much powdered strychnine as will lie on the point of an ordinary pocket knife should be placed in the cut made. Baits should, if possible, be laid along a trail, and will attract a fox even when dried. The laying of poison along ridges which foxes frequent for the purpose of having a look round, and along the edge of scrub and thickets which form their retreat, and wherein they rear their young, and the dragging of some trail such as a sheep's paunch and the placing of baits at intervals along the courses taken, are points duly emphasised by all authorities. The finding of a dead lamb with the tongue missing declares the existence of a fox somewhere in the vicinity, and the lamb thus discovered should be poisoned, for the fox will return later on, probably the same or following evening. Foxes are said to be shy of a sheep that has been skinned, but there can be no doubt that their courage is a rising or a receding quantity in proportion to the cravings of hunger, or the needs of a litter of pups. They have been seen to kill a grown sheep, and they have also been seen to be defeated by a ewe defending her lamb. Our ground game, including the wild turkey, will suffer severely if this new pest becomes at all numerous. The writer has known a fox to get over a six-feet wire-netting fence to attack poultry. When fowls are roosting in a tree, a fox will run round and round the tree, especially on a moonlight night until, sooner or later, as though mesmerised, one of the birds will drop on the ground, to be speedily snapped up. I have heard it questioned if the fox will attack sheep if rabbits abound, but the day is past for giving the fox the benefit of the doubt. If some prefer young rabbits to young lambs, that does not prove that all of them do. It is only a matter of time and opportunity for the fox to develop an appetite for the more costly victim.

EXTERNAL PARASITES OF SHEEP.

L. J. NEWMAN, F.E.S., Entomologist.

SHEEP LICE.

Amongst insects which continually live on domestic animals propagate on them, and when their numbers increase cause serious injury to their host, none are perhaps worse than the various species of lice.

During the past few years these parasites have shown considerable increase amongst our flocks. In Eastern Australia it is stated that the heavy annual loss to the material wealth resulting from the presence of lice amongst sheep is immense, being greater than that caused by the so-called Sheep Tick (*Melophaga ovinus*).

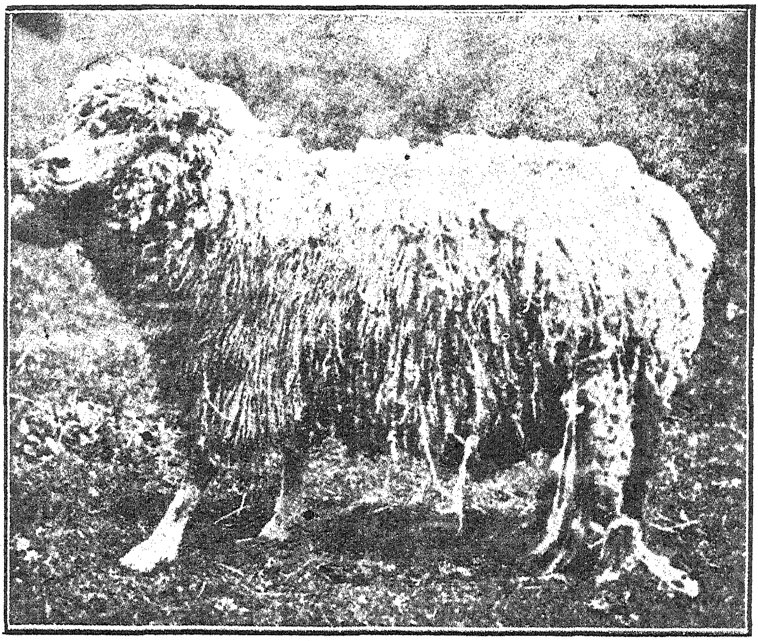
Two species of lice have been determined as present and infesting our local sheep, namely, the Red Headed Sheep Louse (*Trichodectus sphaerocephalus*) (*Nitzsch*) and the Foot Louse (*Linognathus pedalis*) (*Osborn*). They belong to the Order *Hemiptera* and to the Sub-Orders *Mallophagidae* and *Anoplura*. In the Sub-Order *Mallophagidae* all members are parasitic, and are known as the biting lice. They do not suck blood by means of a proboscis or beak. Their mouth parts are formed for feeding upon hair, feathers, skin, scales, clots of blood (formed by the infested animal scratching and biting itself) and scabby or other scurvy material found upon the skin or amongst the hair and feathers of their hosts. These lice are most commonly found upon birds. Nearly all farm animals, however, are subject to infestation by some species of this sub-order.

The *Mallophagidae* or biting lice are all small flattened insects, having large prominent head, outstanding eyes, and short, three-jointed antennae or feelers. The legs are short and stout, fitted for holding to and also moving among hair or feathers. The tarsus or foot is terminated with a sharp claw.

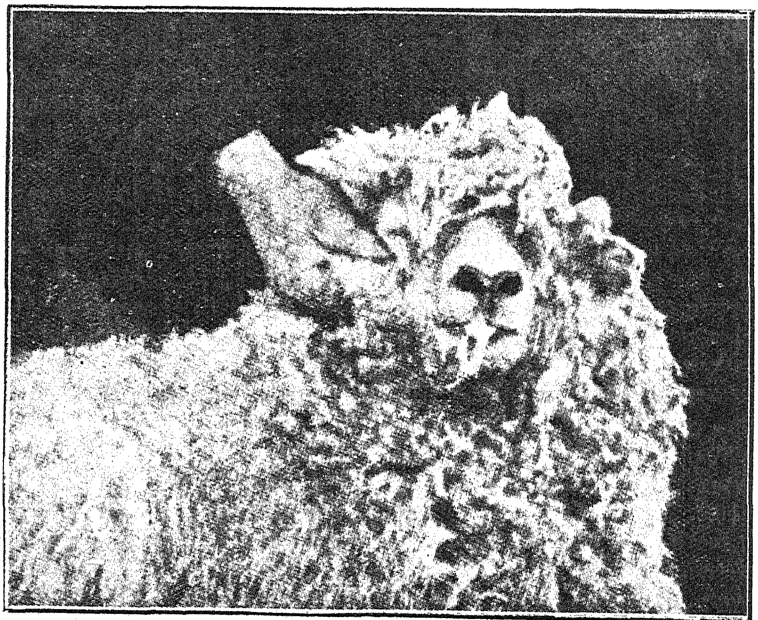
The eggs, commonly known as "nits," are fastened to the hair or feathers of the host. The young issue from the eggs in a few days. They resemble their parents, except in size, and reach sexual maturity by a series of moults. Their entire life is passed on the host. They are spread from animal to animal mainly by means of contact. Other mediums of spreading are posts, fence wires, tree trunks, and objects against which the lice-infested sheep scratch themselves. Infested wool is often left clinging to these containing either "nits" or living lice. Clean sheep may rub against these objects and thus become infested.

The second group of lice, namely, the *Anoplura*, are the true blood suckers. They differ primarily from the preceding group in that their mouth parts are formed for piercing the skin and sucking up the blood of their host. Further, they are only found infesting mammals (those animals which suckle their young). Their life history is similar to the biting lice and, therefore, needs no further description at this juncture.

All breeds of sheep appear to be subject to the irritating attacks of lice and tick. Animals attacked by lice are extremely annoyed by them, and fall away considerably in condition, partly by the abstraction of juices and partly by the uneasiness which the itching occasions. We not infrequently observe



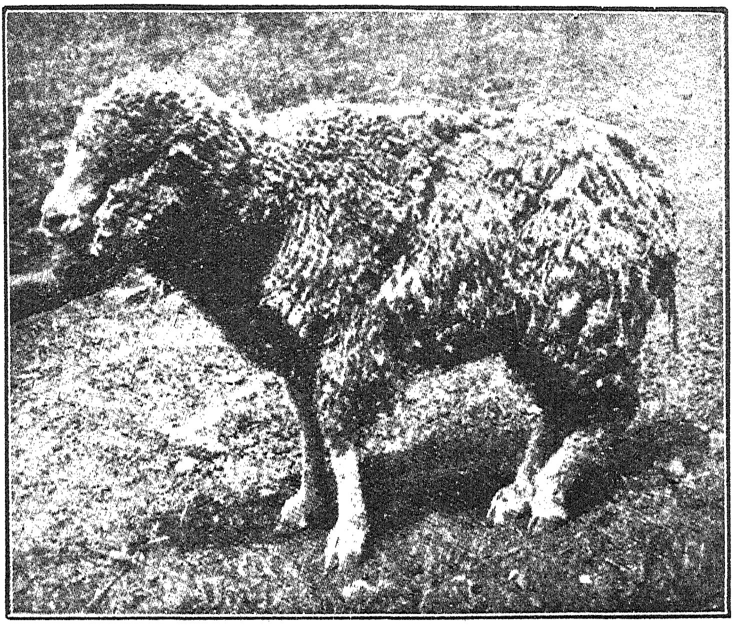
Sheep infested with Louse and Tick. Note torn and ragged condition of fleece, due to rubbing.



Tag of wool in mouth of sheep pulled out in its effort to get at the irritation.

sores on the surface of the skin arising either from the gnawing of the lice or from frequent rubbing of the animal against the fence posts, trees, etc. Sheep often tear off their own wool in their endeavour to get at the itching skin.

The presence of lice can be detected by the tufts projecting over the uniform surface of the fleece. The cumulative increase of lice is very rapid, especially upon animals which have become poor in condition through lack of



Infested sheep, showing typical tufts of wool projecting over the uniform surface of fleece.

proper nutritive foods, or due to some disease. The exceedingly prolific increase has led to the vulgar statement that a louse might be a grandfather in 24 hours. This is, of course, not literally true, but simply indicates that where animals which have become infested and probably living under dirty conditions are not attended to, they soon become poor in condition and consequently heavily infested with lice.

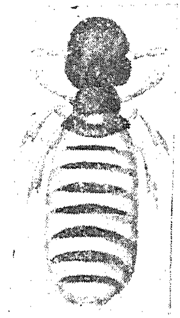
Another important fact, other than the loss of weight and ragged texture of the wool, is the depreciation of the fleece by staining, which arises from the excreta of the lice.

THE RED-HEADED SHEEP LOUSE.

(*Trichodectes Sphaerocephalus, Nitzsch.*)

Description.—This little red-headed louse is very small, slightly exceeding 1/25th of an inch when full grown. It is of a pale brownish colour, almost transparent, with the head more dense and reddish, body flattened, head broader than long, eyes outstanding, antennae short and three-jointed,

legs short, thickset, and yellowish, with one terminal claw, eggs or "nits" fastened on to the wool, dirty white, hatching in from six to eight days. The young reach sexual maturity in 16 to 18 days from hatching. Thus we have a complete life cycle every three weeks. The adult insect is apterous or wingless, and may lay 100 or more eggs.



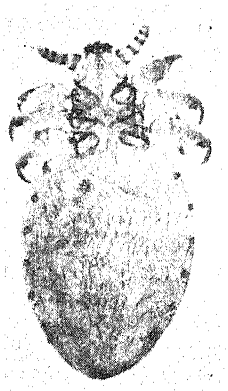
Red-headed Sheep Louse.
Trichodectes sphaerocephalus (*Nitzsch*).
× 50.

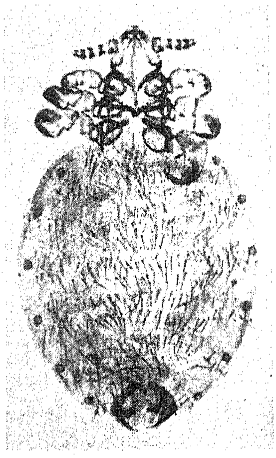
This louse is distinguished by the darker dorsal median bands on each of its abdomenal segments, and is only found infesting sheep. It is commonly found near the skin, on the upper parts of the neck, shoulders, back, and thighs. When in great numbers on an animal in low condition, it will be found on all parts of the body.

SHEEP FOOT LOUSE.

(*Linognathus Pedalis, Osborn.*)

This insect has been discovered during the last year or two infesting sheep in several districts. As its name infers, it is found about the feet, fetlocks, and undersides of the legs towards the belly. It differs entirely from the previously described louse in size, shape, and mouth parts.

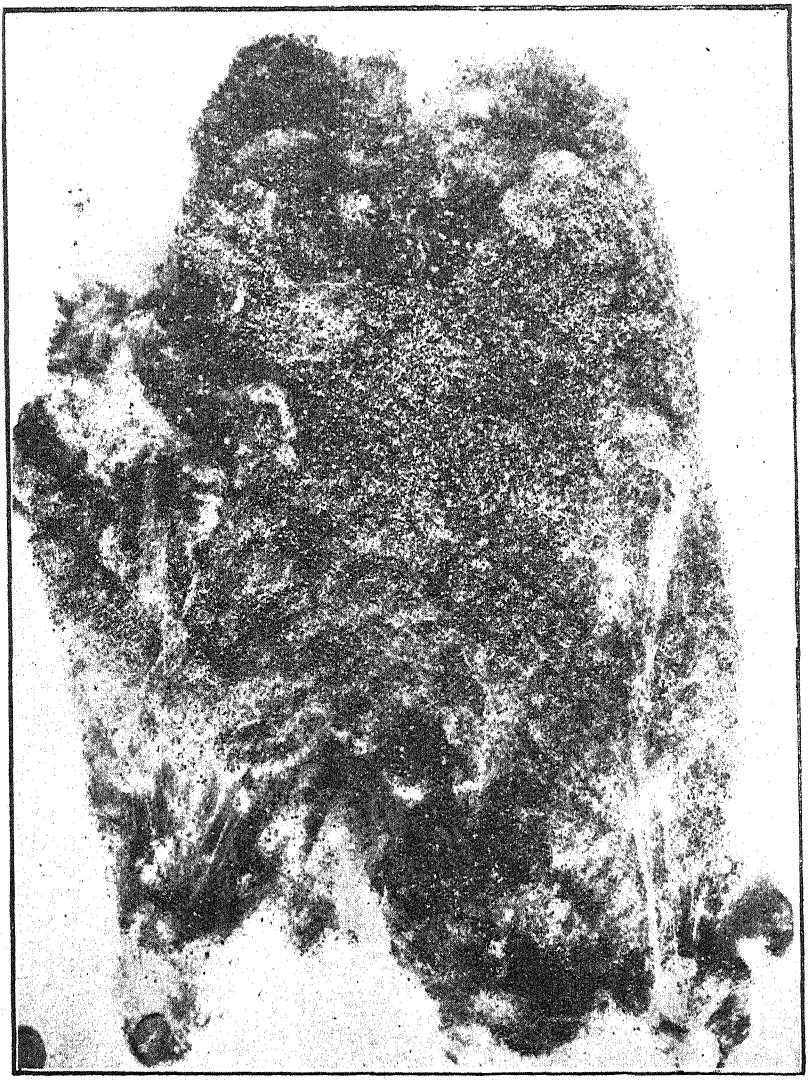




Sheep Foot Louse, *Linognathus pedalis* (*Osborn*).
× 50 Male. × 50 Female.
(Original.)

Its mouth parts are adapted for piercing the skin and sucking the blood of the host animal. It follows, therefore, that should it become abundant upon an animal, the injury would be more severe than that caused by the biting lice which do not puncture the skin.

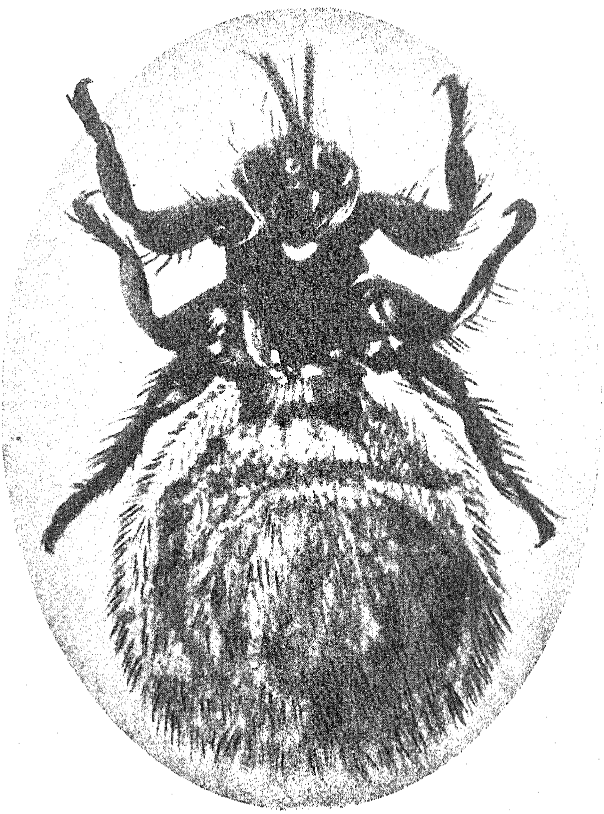
Fortunately, this pest is, so far as we know, confined to several isolated areas, whereas the biting louse is more or less widespread throughout the State. As far as I have been able to ascertain there does not appear to be any previous record of this insect in Australia. (*Haematopinus ovillus*) has been reported in New South Wales (see *Journal of Agriculture*, April, 1923). Judging, however, from the statement therein made that the eggs were found on the wool of the belly, legs, and thighs, I am of opinion that the louse then found is identical with the one herein recorded (*Linognathus pedalis*).



Portion of wool from fetlock of sheep, showing masses of louse eggs or "nits." (Original.)

Description.—The foot louse has a short head, as wide as it is long, which merges into the thorax, mouth parts for piercing or sucking. There are no eyes apparent. The antennae large, five-jointed, pointed, terminal joint with three or four bristles. The body is about 1/12th of an inch long and 1/25th of an inch wide, being considerably longer and wider than the biting lice. The males are broader and flatter than females. The legs are strong and terminated with a powerful claw. Anterior or front pair smallest, posterior pair largest. The white eggs or "nits" are attached to the wool on lower part of leg and foot, a short distance from the skin. They take slightly longer to hatch, but otherwise the life history is very similar to the sheep louse.

There are other lice infesting our pigs, horses, etc., but the purpose of this article is to deal only with those species infesting sheep.



The Sheep Tick—Female.
Melophagus ovinus (*Linn*).
× 13. (Original.)

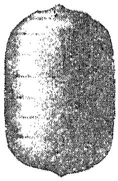
THE SHEEP TICK.

(*Melophagus ovinus*, Linn.)

This so-called tick is not a true tick, but is a wingless parasitic fly which passes the whole of its life stages on the body of the sheep. There are various vernacular names attached to this insect, namely, "Ked," "Louse Fly,"

and "Sheep Tick." It is a blood-sucking insect that is now widespread in many sheep-producing countries, and is certainly well established and widespread throughout the flocks of this State.

This wingless fly belongs to the great Order of *Diptera, Family Hippoboscidae, Genus Melophagus*. This insect is curious in that it does not lay eggs as do most *Diptera* or flies. The egg is retained within the body of the mother, hatches therein, the larva becoming full grown. It is then given birth to, enveloped in a soft membrane, which quickly hardens into a shell around the larva, forming what is called a puparium wherein it pupates. The larval stage of this fly does no harm whatever, the blood-sucking habit of the adult being the cause of all the trouble. The pupa is attached to the wool by a glue-like substance. These shell-like pupæ are in error called eggs.



Pupa of Sheep Tick, in error called the egg.

In from 20 to 25 days after being deposited the pupa is broken open by the tick, which emerges and becomes at once an active blood sucker. Four to six days later it reaches sexual maturity, and 10 to 12 days later the female deposits her first pupa. Each female is capable of depositing several pupæ. We therefore have the following life cycle egg and larval stage within the mother seven to 10 days, from birth of larva enveloped in soft pupa case to emergence of tick 20 to 25 days, in 12 to 14 days after emerging from the pupa the female is depositing her first pupa. The life cycle is completed every 39 to 49 days.

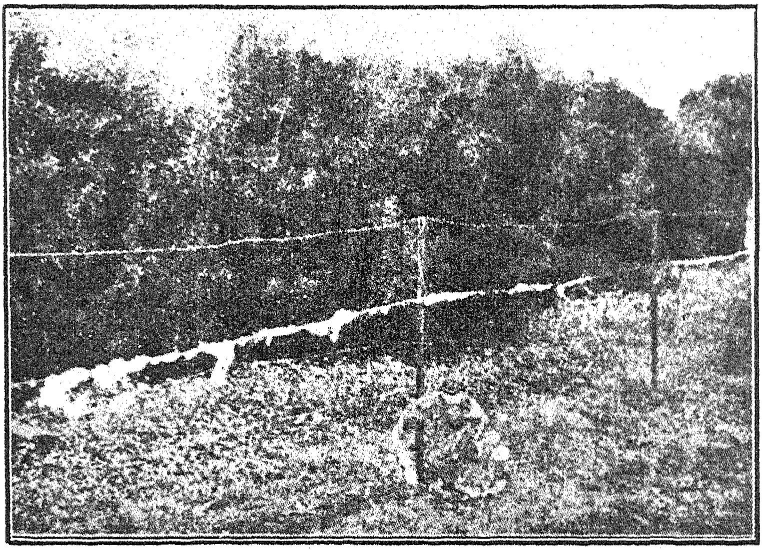
In treatment, therefore, it is necessary to repeat the dipping 20 to 25 days later, thus destroying any ticks that may have emerged from pupæ which resisted the first treatment.

Description.—As before stated, this insect is not a true tick, but is a wingless fly. It has six legs, whereas the true ticks have eight when adult. The mouth parts are very similar to those of other blood-sucking flies. The legs are fairly long, strong, and terminated with two powerful long claws. The antennae are unobservable. Upon the head may be seen a pair of stout stylets, the piercing mouth structures, which are tipped with several strong hairs. The adult is about a quarter of an inch long, of a reddish or grey-brown colour. The body is distinctly divided into head, thorax, and abdomen, which again distinguishes them from the true ticks, which have the thorax and abdomen fused, with a very inconspicuous head. The fore part of the body is uncommonly small. The abdomen is, however, proportionately very large, especially when the insect is well gorged with the blood of its host or is carrying a well-developed pupa. They have a rapid motion when disturbed, running rapidly forward or sideways and backwards like a crab. The neck, breast, shoulders, belly, and thighs are the favoured locations on the host.

Injury.—This parasite, like the blood-sucking lice, lives upon the blood of sheep, which it obtains by sinking its sucking tube into the flesh.

When numerous they cause great irritation, loss of blood, interference with feeding, with consequent loss of condition and vitality. The sheep, when brought to this condition, are then unable to resist other diseases. The wool is lowered in value owing to its being soiled with the excreta and matted together with the pupæ. The sheep also scratch, bite, and rub themselves, causing the fleece to become ragged and broken in staple. The lambs of the flock suffer most from the ravages of this pest, and, if they become heavily infested, receive a set-back at an important period in their development.

How the pest is spread.—Although this insect does not seem to possess the instinct of migration to any extent and cannot fly, nevertheless, once introduced into a flock it soons spreads. This is particularly so where sheep are frequently herded or yarded. When in contact with each other the tick readily passes from one animal to another. There are other means of spreading, such as on dogs or other animals which have come in close contact with



Infested wool clinging to wire fence afer sheep have been scratching.

infested sheep. Men working amongst infested sheep sometimes carry the parasite on their clothing, and may thus be the means of introducing them into a clean flock. Scratching posts, fences, wires, trees, etc., against which the sheep have rubbed and dislodged some infested wool may be the medium of conveying the pest to a clean sheep should same come in contact. If tick is suspected, part the wool over the neck, breast, shoulders, belly, and thighs, when they will be readily detected (Fig. 5).

In the interests of the sheep and wool industry, it behoves all owners to make themselves acquainted with these external parasites, so that they can recognise these pests in their initial stages of introduction to the flock. The next step is to take prompt and correct measures for their treatment, and if possible, eradication.

Wool on neck of infested sheep parted, showing ticks and pupae.

THE SHEEP LOUSE.

HUGH MCCALLUM,
Sheep and Wool Inspector.

ECONOMIC ASPECT.

Owing to the ravages of the external parasites which are infesting our flocks, namely, lice and tick, our wool, and also the carcase, has suffered considerable depreciation. In these times of great demand for wool and sheep at high prices, we cannot afford to temporise with these parasites. The sheep farmer must come to a realisation of the fact that unless he makes a determined effort to eradicate or control these pests, they will sooner or later reduce his sheep and wool to such a state that they will prove unprofitable.

Many of our local clips have held their own with the best of Australia. It has always been noted that the highest values obtained for sheep or wool have been from those sheep that had the necessary care and attention. The owners of these high-priced wools have shown a careful and intelligent interest in their sheep. The stations or farms have been equipped with facilities for dipping, draining yards, etc.

The prevention of this ever-increasing loss is not a matter of difficulty. The initial outlay in providing the dips and other facilities is soon offset by freeing the sheep of the parasites and the consequent heavier fleece and carcase, which means enhanced prices. It is a great and common mistake of many farmers to neglect these provisions on the grounds that they cannot afford the outlay. "A stitch in time saves nine" is a very true saying, and is very applicable when dealing with lice and tick. A pound spent in prevention or treatment means the saving of many pounds later on.

Sheep that are infested with these parasites give birth to weakly lambs. These in turn become infested, and their development is greatly retarded; thus again is the farmer the loser.

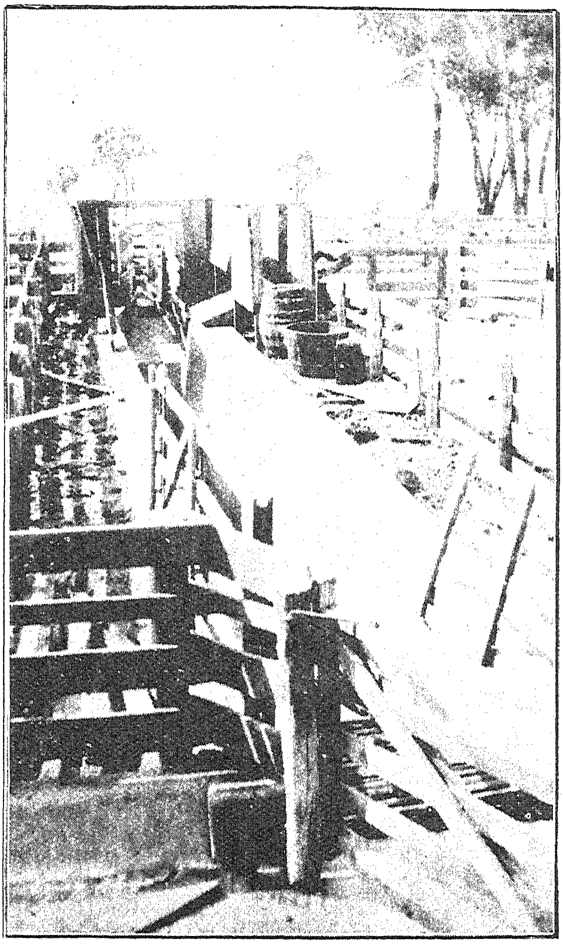
Wool freed from tick and lice is bright, clean, and attractive contrasted with that produced by infested sheep, which is of much inferior quality. It is difficult to estimate the actual financial loss which follows neglect, but sufficient is it to state that it runs into many thousands of pounds per annum.

There is another aspect of the case which is a serious one, namely, the infestation of clean sheep by the yarding of infested sheep in public or private saleyards. These yards become infested and clean flocks which are being offered for sale pick up these lice or ticks. This often means that the buyers unknowingly take infested sheep on to their property, and thus introduce the pest into otherwise clean areas.

Some difficulty may be experienced by farmers in recognising these pests, but it is hoped that a reference to the notes provided in this article by the Entomologist will assist in this respect.

It is the hope of this Department that before many years all farmers will be the possessors of sheep, which are a necessary adjunct to successful farming—hence the reason for all concerned being made acquainted with the need for taking all precautions against the introduction of these pests and making themselves acquainted with the methods of prevention and treatment.

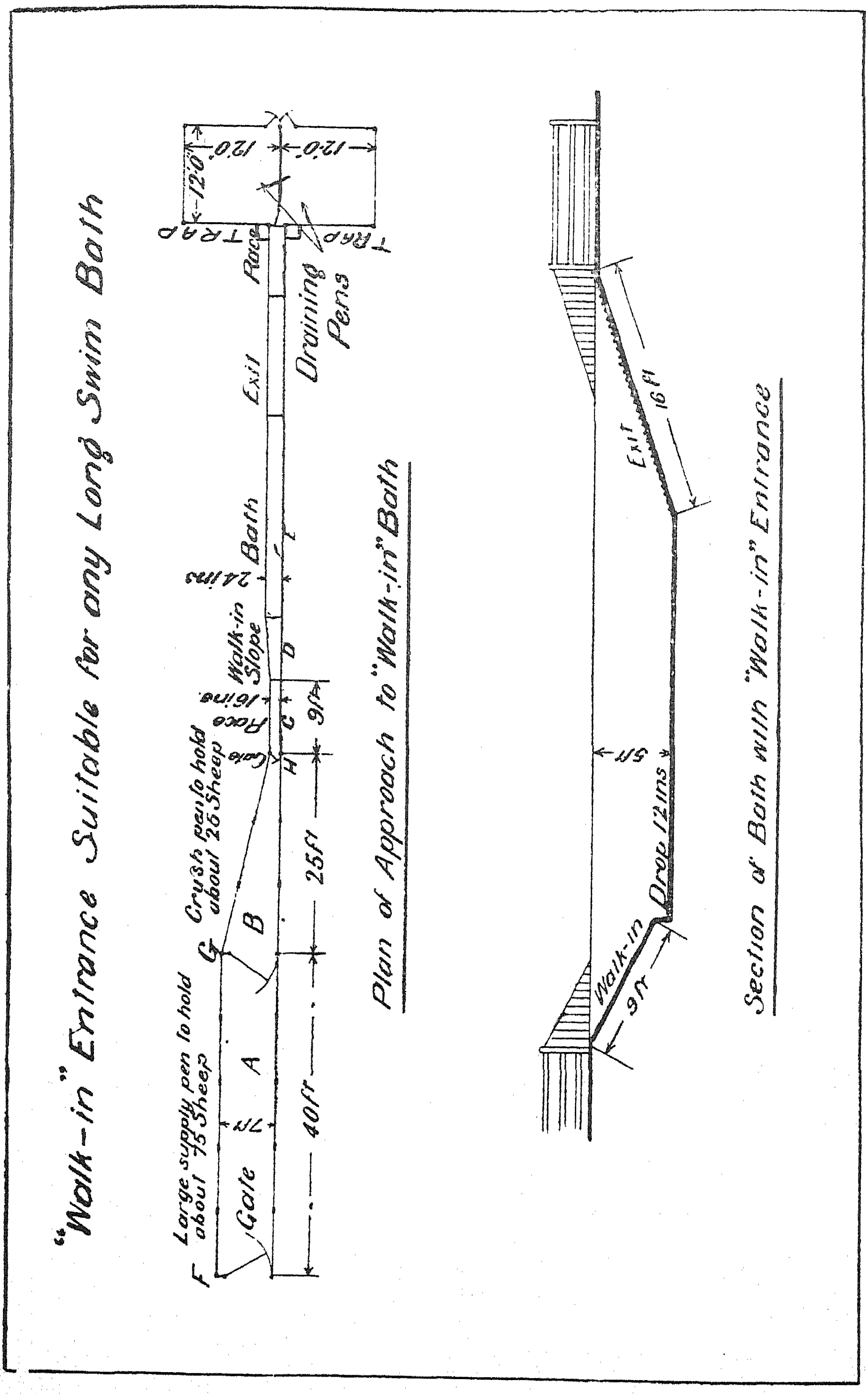
Sheep Parasites and the Dip.—When sheep are infested it is necessary that a dipping mixture be applied to destroy the parasites. Sheep are often rushed through the bath, with the result that the dip does not reach the skin, and consequently the pests remain more or less unaffected by the treatment. The dip must penetrate to the skin, not only to destroy the existing parasites, but to protect the animal against becoming re-infested. It is imperative that all owners realise the importance of this and discontinue the habit of



A modern Sheep Dip.

rushing the sheep through the dip. Regular dipping is essential, and the instructions issued regarding this must be strictly carried out. Each animal put through the dip requires to be soaked for not less than a minute. Sheep should be dipped from four to six weeks after shearing.

To make a complete success of dipping it may be necessary to repeat the operation some 20 to 25 days later. This, as the Entomologist points out,


"Walk-in" Entrance Suitable for any Long Swim Bath
Large supply pen to hold about 75 Sheep
Crush pen to hold about 26 Sheep
Gate
Race
Walk-in Slope
Bath
Exit
Race
TRAP
TRAP
Draining Pens
12'0"
12'0"
12'0"
7ft
16ins.
24ins
40ft
25ft
9ft
Plan of Approach to "Walk-in" Bath
Walk-in
9ft
Drop 12ins
5ft
Exit
16ft
Section of Bath with "Walk-in" Entrance

is owing to the failure of the first dip to destroy eggs or pupæ, which are very resistant stages.

Care before and after Dipping.—Adverse climatic conditions at the time of dipping can, and do, have a detrimental effect on the result. They are, however, beyond our control, but by using a dip of unvarying and guaranteed constancy and following the instructions, good results will be obtained. The care and condition of sheep before and after dipping are matters which should not be overlooked.

Sheep should not be dipped during extremes of heat or cold, when thirsty, or in a heated state from driving. When ewes and sucking lambs have been dipped the lambs should be kept apart for a time.

In districts where each farmer cannot afford to put in a separate dip, the matter of installing one on the co-operative system should meet with general support. This can be erected at little cost by the interested parties.

For the information of farmers a diagrammatic plan of an effective sheep-dipping tank has been prepared, and is submitted herewith.

The particulars regarding the materials used in the preparation of the dipping fluid will be found in "The Eradication of Lice and Tick in Sheep," by Mr. Murray-Jones, the Chief Veterinary Officer.

EXPLANATION OF DIAGRAM.

Sheep-dip—"Walk in" Entrance. (*See plan.*)

A and *B* are supply and crush pens, which are fed from the usual sheep yards, with which the former should be connected. The latter should have a battened floor, the battens being made in sections, so that they can be removed after dipping.

C race, nine feet in length, 16 inches wide, sufficient to hold four sheep. This race should have a battened floor, to be removed after dipping.

D represents the "walk-in" section, and is an incline nine or 10 feet in length (10 feet is better), gradient one in two, ending in a drop of 12 inches above the bottom of the bath. Its width at the point at which it connects with the race is the same as that of the race itself, namely, 16 inches; hence it gradually widens to 24 inches, to connect with the bath at the other end, of which it practically forms a part. The sides of the "walk-in" section are also, in all respects, identical with those of the bath.

E, portion of the swim bath.

F, G, H, represent gates; *F* and *G* are 4 to 4½ feet gates hung on posts 3 feet or 2½ feet from the side fence, so that when open they will close up the angles and form a "lead in." *H* is a small gate to close the four sheep in the race.

Two draining pens, each 12 by 12, are necessary, and a shed could be erected over same if required.

The size of the above dip can be reduced to meet the requirements of the small stock owner. A dip from 15 feet to 25 feet long is large enough for a small flock.

ERADICATION OF LICE AND TICK IN SHEEP.

F. MURRAY-JONES, B.V.Sc., M.R.C.V.S.,
Chief Veterinary Officer.

The attention of pastoralists, farmers, and stockowners generally cannot be too forcefully directed to the immediate necessity for using every means within their power in adopting suggestions set out in this article for their guidance in eradicating both lice and tick from their flocks. It is a serious reflection on the part of those persons concerned in the management of their flocks to allow lice or tick to continue to infest their sheep. To advance the plea that they were unaware of their existence shows that insufficient care is being exercised in their supervision. On the other hand, to be aware of the existence of these parasites and fail to adopt remedial measures, is even more culpable. It is pointed out that to travel, or expose for sale in a public place, sheep which are infested with tick or lice becomes an indictable offence for which penalties are provided under "The Stock Diseases Act, 1895."

At the present time there is undoubtable evidence of the unsatisfactory state of many of our flocks, and in some parts of the State the parasites have spread with such rapidity that within 12 months infestation has increased 100 per cent. In one of our chief markets (Midland Junction Saleyards) a large number of cases have been noted by inspectors of this Department of the presence of both lice and tick, and if this state of affairs is allowed to continue it must eventually react to the disadvantage of the State's sheep industry as a whole, and further, a serious monetary loss is sustained through deterioration in the marketable quality of our wool. Lice and tick in sheep, if allowed to continue, must eventually go from bad to worse, therefore all persons concerned should realise the position and determine on the right lines to stamp the trouble out.

Remedy.—In order that a remedy may be effected, it is first necessary to obtain evidence by examination as to the existence or otherwise of lice or tick in your sheep. In order to do this the sheep should be seized and placed in a sitting position between the feet of the operator with the back of the animal resting against the legs. Special attention should then be paid to the unexposed portion of the body between the chest and the forearms—on the belly, beneath the jaw and the under portions of the neck. Afterwards the back and flanks should be examined.

A full description of both the sheep louse and the sheep tick and how to identify is supplied in this article by Mr. L. J. Newman, Economic Entomologist. (See page 99.)

Dips and Dipping.—The class of dip used depends upon the number of sheep required to be dipped. For general requirements one cannot do better than adopt the type recommended by the Departmental Sheep and Wool Expert (Mr. McCallum), particulars of which have been previously published but which are reproduced in this article. This can be modified to suit requirements peculiar to the owner.

The best time to dip is one month off shears for short wools, and six weeks for long wool varieties. However, in some parts of the State one recog-

nises the difficulty of a second muster, and in those cases dipping off shears is the only alternative. When this is the case every care should be taken to see that the animals are effectively dipped—preferably in a swim dip.

The advantage of dipping with a month's wool on is obvious, as it affords an opportunity for the solution to take hold, and in consequence the efficiency of the operation is enhanced. Care should be taken not to dip sheep when hot after travelling or when thirsty. Thin sheep require more gentle handling than strong vigorous ones. When dipping off shears it is always advisable to dress shear cuts with a dab of antiseptic dressing, supplied by dip manufacturers, before immersing.

Kinds of Dip to use.—There are many makes of dip on the market, but the only kind recommended by this Department is one containing one-tenth per cent. of arsenious oxide. This class of dip has been proved throughout the Commonwealth to be the most efficacious, and, in consequence, the cheapest in the long run.

Lime and sulphur dips should be avoided except in cases of scab. Lime has a detrimental effect, as it causes the fleece to become hard and harsh in texture, stunted in growth, and a bad colour. From a manufacturing standpoint these are most objectionable, causing dyeing faults and, ultimately, indifferent fabrics.

Lime renders fibre brittle, stunts growth, destroys elasticity, causes difficulty in scouring, spoils it for taking dyes, and, finally, can only produce low grade fabrics.

Tobacco dips are objectionable, as wool from sheep so dipped is not suitable for making even ordinary fabrics, and, further, has been proved absolutely useless in regard to the destruction of lice and tick.

Carbolic and alkali dips are not recommended, for the reasons set out in connection with tobacco dips.

The only point to remember in connection with the use of the prescribed arsenical dip is to carefully execute the directions issued by the manufacturers given on packet or container.

The dip should be tested from time to time, so as to ascertain the right strength is being maintained.

A PURE BRED BULL'S ARITHMETIC.

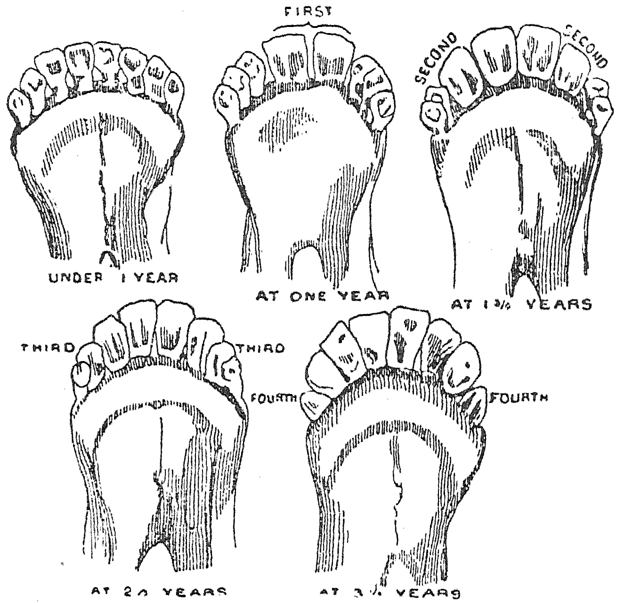
"I am not strong on arithmetic" said the pure-bred bull, "but I can add to the bank account of the man who owns me; I can subtract from the principal of his mortgage; I can multiply his chances for success; I can divide his cares and worries; I can give more interest to his work; and I can discount his chances for loss."—*Live Stock Bulletin.*

DENTITION OF SHEEP.

HUGH McCALLUM,
Sheep and Wool Inspector.

A most important matter in the keeping of sheep is that of judging the age of the animals. From the number of inquiries received at sheep demonstrations, a description of the sheep's mouth from birth to maturity will be useful to those whose knowledge of sheep is small.

Sheep have thirty-two teeth, as follows:—Incisors, eight, which are situated in the front of the lower jaw, by which the age of the sheep is reckoned, and molars or grinders, six each side on both jaws. At birth a lamb possesses two temporary central incisors, and at the end of four weeks all the tem-

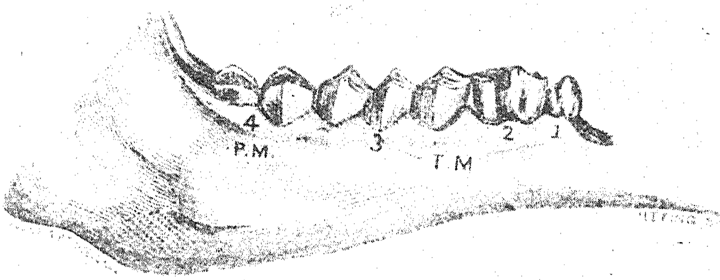


Dentition—Incisors.

porary incisors (eight) are up with the three molars in each of the upper and lower jaws (first, second, and third temporary molars). At three months the fourth molar is cut, and is permanent. Ninth month another molar (the fifth) is to be seen. At eighteen months the sixth permanent molar is cut. The third temporary molar covers the top of the permanent molar, while the first and second permanent molars push off the temporary ones. Thus a sheep has all its permanent molars at from eighteen months to two years old.

The molar teeth are used for masticating the food, their surfaces being irregular and suitable for grinding.

With the incisors, the first two or central permanent teeth make their appearance at from twelve months in early to fifteen months in late dentition.



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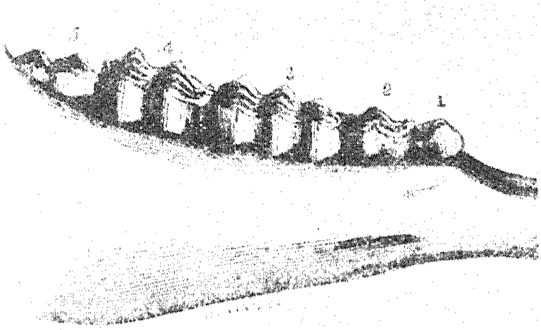

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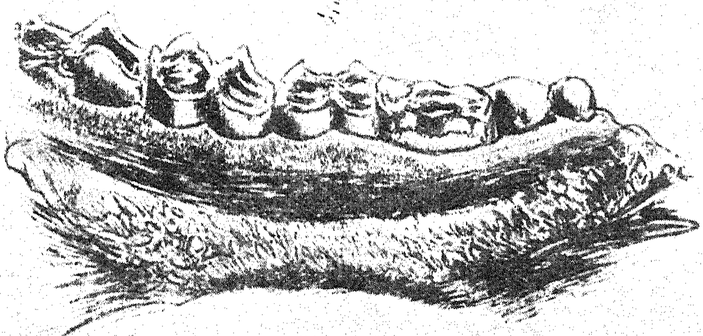

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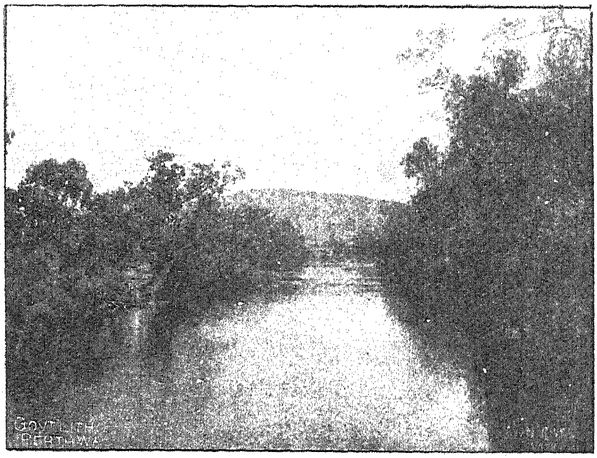
Dentition—Molars.

The sheep is then known as a "two-tooth" or "hogget." At two years of age the two teeth on either side of the central teeth are replaced by two permanent teeth. The sheep then becomes a "four-tooth." At three years of age two more permanent teeth make their appearance, and the sheep is then described as a "six-tooth." At four years of age two more permanent teeth appear, and it is then an "eight-toothed" or "full-mouthed" sheep.

From this onwards the age of sheep cannot correctly be determined by the teeth. From about five years of age the central teeth will show signs of separating in the middle, and as the sheep becomes older the other teeth will separate, and may be broken. With age the teeth become worn down or lost, and the sheep is then known as "broken mouthed." Sheep have been known to retain good teeth until an old age. The wear of the teeth all depends upon the class of country, the early or late maturity of the breed, and whether the mouth is defective or otherwise.

In the case of broken teeth it is wise if only three or four or fewer teeth are left to pull them out and leave the animal "gummy." Sheep cannot bite with odd or gapped teeth as well as they can with gums. The best advice is not to pasture or purchase old sheep if younger ones are procurable. Indications of old age are sagging of the loins, distended nostrils, and deterioration of the fleece in quality and quantity.



FARMERS' FIELD TRIALS.

H. RUDALL,
Field Officer.

Farmers' field trials were again carried out last season, at various centres, with wheat, oats, rate of seeding, rate of super and mixed fertilisers, and the results obtained are worthy of attention. The areas of the plots were .45 to .5 of an acre, all duplicated.

WHEAT TRIALS.

The wheat trials were carried out at Gutha, Bencubbin, Narembeen, and Dalwallinu, with early and very early varieties. Merredin and S.H.J. were compared with the two old standard varieties Gluyas Early and Florence. Only at one centre (Bencubbin) was a control or check plot used, namely, Canberra, comparing with Gluyas Early and Merredin.

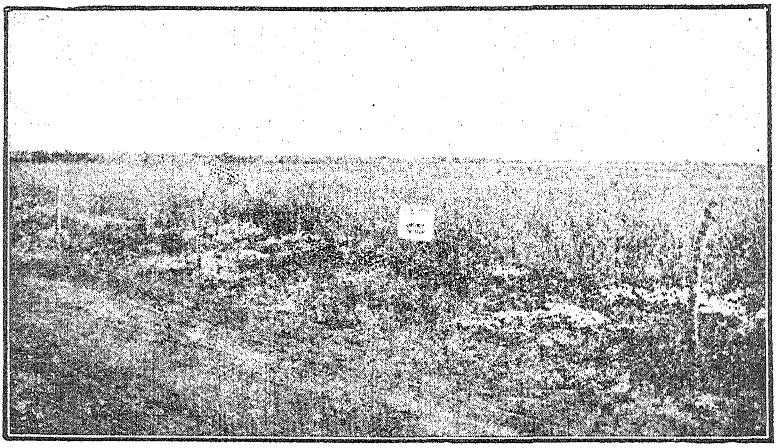
At three centres only (Gutha, Carnamah, and Dalwallinu) were the early and very early variety trials carried out. Two sowings were made so that the very early maturing varieties could be sown seasonably during the latter portion of the sowing season. A comparison of the individual computed yields per acre of the different varieties can be made from the following table:—

Farmer.	District.	Type of Soil.	Florence	Gluyas Early.	Merredin	S.H.J.	Control Plots.	
							Yield.	Variety.
			bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	
R. Bicket...	Dalwallinu	Red loam ...	13 13	13 10	15 57	12 19	...	
W. J. Eva	Gutha ...	Light, fluffy yellowish	10 32	16 18	19 3	10 29	...	
B. W. Hopwood	Bencubbin	Light red friable loam	...	21 31	23 23	...	20 22	Canberra.
F. Noble...	Narembeen	Red clay loam...	...	16 26	17 10	...	...	

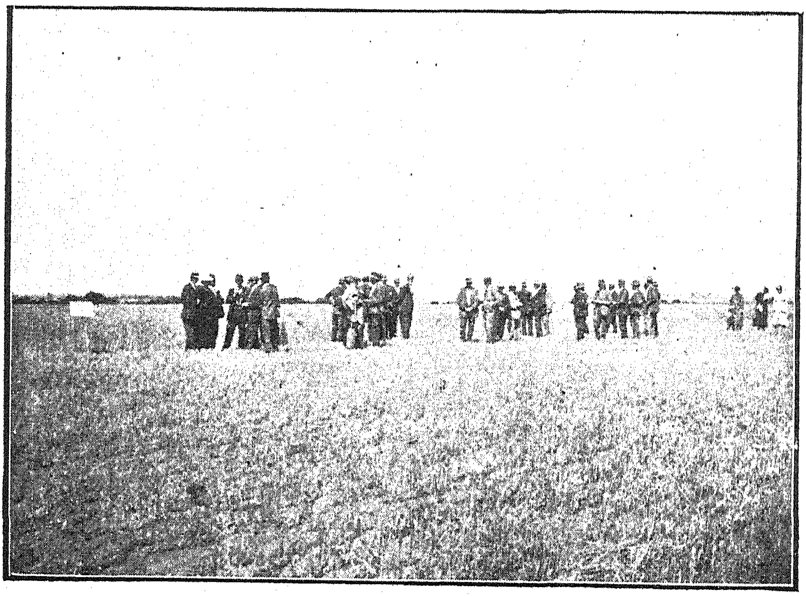
OFFICIAL RAINFALL, 1924, AT OR NEAR EACH CENTRE.

District.	Jan.	Feb.	Mar.	April	Useful rains.							o.	Dec.	Total.
					May.	June.	July.	Aug.	Sept.	Oct.	Total useful rain.			
Bencubbin (Mt. Marshall)	...	119	54	23	155	160	124	220	62	162	883	44	...	1,123
Carnamah ...	...	...	...	13	95	264	371	222	61	126	1,139	62	...	1,214
Dalwallinu ...	...	...	28	11	123	256	263	198	89	142	1,071	44	...	1,154
Isseka	...	...	52	6	161	431	335	325	133	174	1,559	52	2	1,671
Tenindewa (Mullewa)	...	1	46	...	92	347	198	172	60	135	1,004	23	...	1,074
Gutha	...	...	136	2	90	282	309	198	46	111	1,036	33	50	1,257
Narembeen (Emu Hill)	...	54	8	34	287	188	102	174	98	146	995	29	7	1,127

The 1924 season cannot be regarded as a favourable one from an average rainfall standpoint, the rainfall being low during the wet months of the year—May, June, and July. The falls were sufficient to ensure good germination and carry the growth forward, but not enough to maintain a storage for the latter part of the season, and the effect of this was very marked during the low rainfall in September whilst the flowering period took place.



Plot of Merredin at Gutha (Mr. W. J. Eva's).



Field Day at Bencubbin Plots. (Mr. Hopwood's).

Where the land was early and well fallowed, this shortage, owing to moisture conserved, was not so marked. The want of moisture caused a good many shoots to die off; and later, when the heads were formed, instead of the spikelets carrying three or more grains, the centre flowers did not set at all, and the majority of spikelets carried only two grains. With the beneficial falls above the average during October, and light showers with low temperatures in November, a great recovery was realised, especially by those who gave due consideration to the careful preparation of the fallow and did not rely upon the amount of rain on the crop.

CULTURAL NOTES.

Gutha (W. J. Eva).—Variety trials, mixed fertiliser trials. Ploughed July, 1923; cultivated September, 1923, April, 1924; sown 8th and 26th May with 45lbs. seed and 100lbs. super per acre.

Bencubbin (B. W. G. Hopwood).—Variety trial, rate of seeding and rate of super trials. Ploughed July, 1923; cultivated with springtyne September; sundercut October and November; springtyne prior to seeding, 1924; sown 14th May, variety trial with 45lbs. seed and 100lbs. super.

Tenindewa (R. A. Oldham).—Rate of super. Ploughed July, 1923; harrowed in spring; cultivated in May, 1924; sown 7th May with 45lbs. seed, Nabawa variety.

Narembeen (F. Nobles).—Variety trial, rate of seed and rate of super trial. Ploughed late in August, 1923, with moulboard; springtyned about middle of September, again in October, 1923, and prior to seeding 1924; sown 21st and 22nd May; variety trial with 45lbs. seed and 75lbs. super.

Carnamah (J. Laing).—Mixed fertiliser. Ploughed July, 1923, and cross-ploughed later; cultivated September, 1923, April, 1924, harrowed twice in May; sown 24th May with 45lbs. seed, Nabawa variety.

Dalwallinu (R. Bicket).—Variety trial. Ploughed July, 1923; cultivated September and October, 1923, with tandem disc and again in April, 1924; plots for very early varieties cultivated again in May; sown 12th and 28th May, 1924, with 45lbs. per acre and 100lbs. super.

RATE OF SEEDING.

F. NOBLES, NAREMBEEN.

Nabawa Variety.

Rate of Seed.	Type of Soil.	Cost.	Yield.	Increase yield.	Decrease yield.	Cost increase of yield.	Cost decrease yield.
		s. d.	bus. lbs.	lbs.	lbs.	s. d	s. d.
45	Scrub plain light colour interspersed freely with gravel	3 5	13 37	...	...	...	...
60		4 7	14 7	30	...	1 2	...
90		6 10	13 3	...	34	...	3 5

B. W. HOPWOOD, BENCUBBIN.

Nabawa Variety.

Rate of Seed.	Type of Soil.	Cost.	Yield.	Increase yield.	Decrease yield.	Cost increase of yield.	Cost decrease yield.
45	Light red friable loam	3 5	21 11	...	...	...	...
60		4 7	21 8	...	3	...	1 2
90		6 10	19 42	...	90	...	3 5

These results support last year's trials, showing that in early districts there is no advantage in using more than 45lbs. to 50lbs. of clean seed per acre.

RATES OF SUPER TRIALS.

B. W. HOPWOOD, BENCUBBIN.

Rate of Super per acre.	Type of Soil.	Cost.	Yield.	Increase of yield.	Cost of increase.
lbs.		s. d.	bus. lbs.	bus. lbs.	s. d.
75	Light red friable loam ...	4 0	21 28	...	...
150		8 0	22 38	1 10	4 0
225		12 0	22 30	1 2	8 0

F. NOBLES, NAREMBEEN.

75	Scrub plain light colour interspersed freely with gravel	4 0	9 52	...	...
150		8 0	12 14	2 22	4 0
225		12 0	10 53	1 1	8 0

R. A. OLDHAM, TENINDEWA.

80	Medium red loam	4 3	23 13	...	...
140		7 5	25 48	2 35	3 2
206		10 11	25 57	2 44	6 8

The reduced yield at Narembeen compared with Tenindewa and Bencubbin is due to the poorer quality of the soil, also the uncertain opening of the season, as during an inspection in September these plots appeared thin, probably due to a proportion of seed having malted.

FERTILISER TRIALS.

W. J. EVA, GUTHA.

Fertiliser.	Computed Yield per acre.	Cost per acre.	Yield.		Cost.	
			Increase.	Decrease.	Increase.	Decrease.
	bus. lbs.	s. d.	bus. lbs.	bus. lbs.	s. d.	s. d.
100 Super	18 58	5 4	...	...	...	...
100lbs. Super., 50lbs. Ammonia	21 14	14 4	2 16	...	9 0	...
100lbs. Super., 25lbs. Ammonia	19 39	9 10	0 41	...	4 6	...
100lbs. Super., 25lbs. Potash ...	19 18	8 10	0 20	...	3 6	...

Soil—Light and a little fluffy, yellowish in colour.

J. LAING, CARNAMAH.

80lbs. Super.	14 4	4 3	...	...	...	...
80lbs. Super., 20lbs. Ammonia ...	11 37½	7 10	...	1 13	...	6 4½
80lbs. Super., 20lbs. Potash ...	14 0	7 0½	...	0 4	...	2 9½
80lbs. Super., 20lbs. Ammonia, 20lbs. Potash	12 51	10 7½	...	1 13	...	6 4½

Soil—Scrub plain very light, yellowish in colour.

The plots at Mr. Laing's were on slightly inferior soil than those at Mr. Eva's, also at one end about three chains long the growth of each plot was affected by the soil having previously grown low wodgil. A perusal of each trial, however, indicates the efficicacy of superphosphate.

FARM IRRIGATION.

A. R. C. Clifton,
Officer in Charge of Irrigation.

Irrigation is the artificial application of water to the soil, enabling successful crops to be grown which otherwise would not be possible owing to insufficient or irregular rainfall. It is mainly practised in arid and semi-arid climates, but is also resorted to in a lesser degree under humid conditions.

The terms arid, semi-arid, or sub-humid, and humid do not refer to the quality of the soil, but are used in classifying areas purely with reference to the annual precipitation. A district with an annual rainfall of under 10in. is termed arid, from 10in. to 20in. semi-arid or sub-humid, and over 20in. humid. A study of the rainfall map of Western Australia discloses the fact that according to the above classification of rainfall zones, seven-eighths of the whole area of the State is arid or semi-arid. There is, however, a certain diversity of opinion regarding the amount of rainfall which determines these three zones, so from an irrigation point of view we may refer as arid to those areas where the whole of the crop is produced by moisture supplied by irrigation; semi-arid or sub-humid those areas where crops are produced partly by the natural rainfall and partly by irrigation, and humid when the whole of the crop can be produced by the natural rainfall, except in dry years.

Practically the whole of the irrigation in this State at the present time is being carried out in the humid South-West. The reason for this is not because irrigation is more necessary or the land more fertile than other portions of the State, but because in this district permanent streams and suitable sites for storing the winter floods by means of dams and reservoirs exist.

Our North-West rivers offer opportunities for irrigation and closer settlement, but these propositions are primarily engineering problems, as the flow of the rivers is intermittent, and storage is necessary before irrigation on a large scale is possible. The time is not far distant, however, when probably the major area under irrigation will be in the arid and semi-arid districts of these Northern rivers.

Practically all the rainfall in the South-West, ranging from 25in. to 50in., falls during the six winter months, and very often arid conditions exist during the summer. It is usually contended that if crops could be irrigated during these summer months the results would more than pay for the cost of irrigation, and this contention has been borne out in many cases.

The installation of an irrigation plant in a humid district should be regarded as an insurance against a dry season, although once the plant is installed it would be very seldom that an application of water would not increase the yield of summer crops. The question is, however, not whether irrigation would increase the yield, but rather, whether the increased yield would warrant the cost, or whether good results could not be obtained, and much more cheaply, by adopting better cultural methods.

Professor S. W. Fletcher in his book, "Soils," points out that "as a general proposition, irrigation under humid conditions is a matter of expediency: it may or may not pay according to the conditions: it is an entirely different

question here from what it is in arid regions; there irrigation is the only way to make farming pay." He goes on to say that irrigation in a humid climate may easily become a cloak for shiftless tillage. This applies to some localities in our South-West, as there are occasions where improved farming methods would to some extent overcome the difficulty.

In our dry areas we find that fallowing and cultivation husbands the natural moisture sufficiently to enable the successful growing of wheat with a 10in. rainfall, and it is a recognised fact that the thorough cultivation of deep soils enables portion of one season's rainfall to be carried on to the next. The quantity so retained depends on the depth and nature of the soil. Deep soils then are most important in both dry and irrigation farming.

The soils of humid areas, however, are not usually so deep or fertile as those of arid, and crops growing on shallow soil feel the effects of hot dry spells if only of short duration, consequently light waterings at frequent intervals are advisable when irrigation is practised under humid conditions and drainage is necessary and must also be provided.

A large part of the moisture received by the soil is lost through evaporation and drainage, and only portion of that remaining is available for plant growth. The amount of water required and frequency of application varies with the kind of crop and its stage of growth, and is also influenced by the soil and climatic conditions. Evaporation is high in soils exposed to hot dry winds, and low in sheltered positions where the air is moist. It will be less in deep soils than in shallow or those which tend to crack after irrigation. It is therefore necessary to check this loss by keeping the surface of the soil stirred by cultivation. This is of primary importance when irrigation is practised, and should be done as soon as practicable after watering.

The whole question of irrigation must be viewed from the standpoint of whether it will pay, and this can only be determined when the cost and value not only of the whole, but of the individual parts are known. The annual cost will be—(a) the actual cash outlay for operation, (b) interest on investment in plant and preparation of the land, (c) and depreciation. These can be estimated after taking into consideration the water supply and height it has to be lifted, the area, contour of the land, and kind of crop to be irrigated, class of soil, and climatic conditions. The foregoing considerations also determine which of the many methods of distributing the water will be most suitable. The difference between the value of the increased yield, due to irriyation, and the cost of irrigation, including any extra farm operations in connection therewith, will be the value.

It is proposed to elaborate on the foregoing in a series of illustrated articles in later issues of this *Journal*, and as the Departmental Bulletin No. 41, "Irrigation and Drainage," by Mr. A. H. Scott, late Irrigation Expert, which dealt with the different methods of applying water to the land, is out of print, this will be largely incorporated.

ROYAL WHEAT CROP COMPETITIONS—ZONE CHAMPIONSHIPS.

GEO. L. SUTTON, Director.

Crop competitions in this State were inaugurated by the Royal Agricultural Society in 1921, when for the purpose of these competitions the Wheat Belt was divided into five zones named, respectively, North Coastal, North-Eastern, Central, South-Eastern, and Southern Zones.

In each of these zones two prizes, valued respectively at £15 and £5, were offered for the best 50 acres of crop of any one variety, which should be judged according to a specified scale of points.

In the following year a few district societies also held competitions, and the next year, 1923, in order to stimulate more interest in this progressive movement and encourage additional societies to hold competitions, the Royal Agricultural Society made a change in the method of entry for the Royal Competition.

Originally the entry was made direct to the Royal Agricultural Society, but, under the new scheme, it was provided that entry in a local district competition also entitled the competitor to compete for the Royal Championship honours, the competitors for these being selected from the first and second prize winners in the district competitions. Experience proved that this plan had one serious disadvantage, in that many good farmers were debarred from competing because their local agricultural societies did not hold crop competitions. This was remedied last year by arranging that competitors so placed should enter directly through the Royal Agricultural Society; at the same time the scale of points was altered slightly. The amended scale is shown hereunder with the original points in parentheses:—

(a) Estimated yield, having regard to the average yields of the district in which the farm is located—35 (30) points.

(b) Free from weeds—25 (30) points; with penalties as follow:—new land—6 (4) points; second crop—4 (3) points; third crop—2 (2) points; fourth crop—1 (1) point.

(c) Freedom from admixture—15 (20) points.

(d) Evenness of growth—10 (10) points.

(e) Freedom from disease, smut, take-all, etc.—15 (10) points.
Total—100 points.

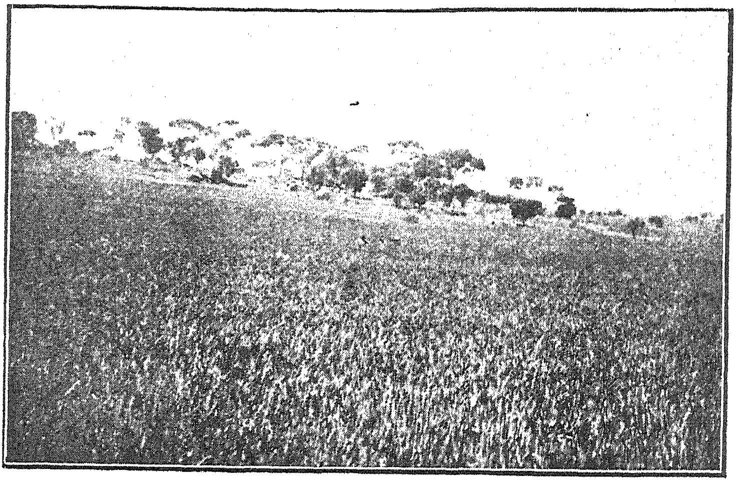
This year the number of zones has been reduced from five to three, which roughly coincide with the rainfall areas, thus:—

Early Zone, or Zone No. 1: With rainfall not exceeding 15 inches.

Mid-season Zone, or Zone No. 2: With rainfall over 15 inches and not exceeding 20 inches.

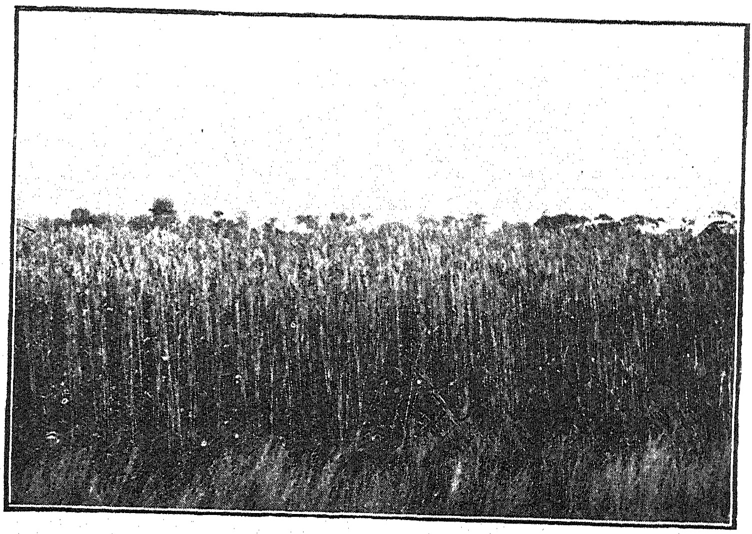
Late Zone, or Zone No. 3: With rainfall over 20 inches.

ROYAL CROP COMPETITION.



Prize winning crop, Zone 3. Variety, Federation.

ROYAL CROP COMPETITION.



Prize winning crop, Zone 3. Variety, Federation.

That the aims of the Royal Agricultural Society for stimulating interest in this movement have been achieved is shown by the number of societies, and also by the number of competitors who interest themselves in this phase of agricultural progress.

The number of competitors and districts represented since these competitions were initiated is as hereunder:—

	1921.	1922.	1923.	1924.
Number of District	...	...	12	15
Number of Competitors	15	32	82	70

The judging of the Royal Crop Competition is done by departmental officers attached to the Wheat Branch, who are also in great demand as judges of the district competitions. This year the judges were Messrs. I. Thomas, J. Langfield, H. Rudall, and W. P. Cass-Smith.

Under the West Australian system of judging the yield is not estimated, but is calculated from the yield of the crop on a number of small areas taken systematically throughout the competition crop, and the grain of which is threshed out.

As far as is known this plan is not practised elsewhere in connection with the judging of wheat crop competitions. Results have shown that the calculated yields so obtained closely approximate the actual yields harvested by the farmer. This plan is believed to be more reliable, and is certainly more satisfactory to farmers, than the allotment of points for yield in accordance with an estimate made by the judge. It, however, has the disadvantage that it limits the time available for judging, and, in consequence, owing to the limited number of judges and the demand for their services, their work during the judging season is particularly strenuous.

Including the districts entering directly through the Royal Agricultural Society there are—

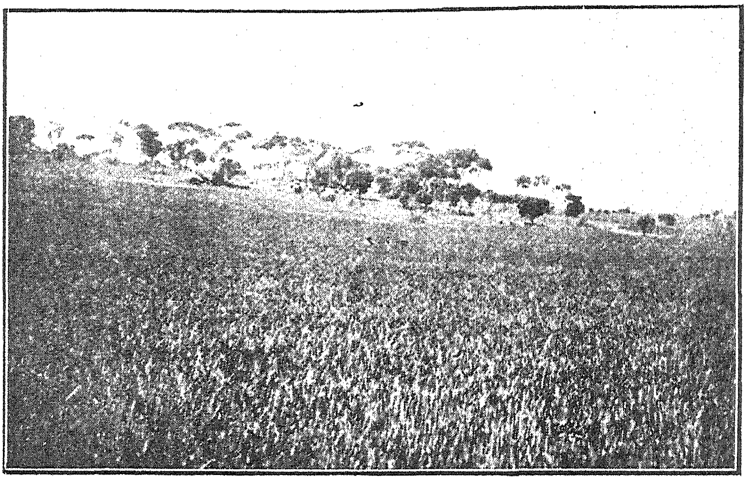
In Zone No. 1, seven districts, viz., Bruce Rock, Dowerin, Tammin, Kellerberrin, Doodlakine, Baandee, Merredin, and Nungarin.

In Zone No. 2, seven districts, viz., Kulin, Beverley, Calcara, Marchagee, Pithara, Three Springs, sand Wongan Hills.

In Zone No. 3, one district, viz., Goomalling.

Fortunately, owing to the West Australian method of calculating yields and the uniformity of methods in the judging of the district competitions, the points allotted in the district competition can be and are, utilised for the championship awards.

ROYAL CROP COMPETITION.



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Fortunately, owing to the West Australian method of calculating yields and the uniformity of methods in the judging of the district competitions, the points allotted in the district competition can be and are, utilised for the championship awards.

The points awarded by the judges in the different zones are as hereunder:—

ROYAL WHEAT CROP COMPETITIONS.

ZONE CHAMPIONSHIPS.

Name and Address.	Variety.	Estimated Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
			Points awarded.				
			Zone 1.				
	Maximum Points ...	35	25	15	15	10	100
Hughes Bros, Minnivale ...	Nabawa ...	35	23	14	14	9	95
Lethlean, J., Bruce Rock ...	Nabawa ...	35	23	14	14	9	95
Hammond, J. D., Kellerberrin	Nabawa ...	34	23	13	14	9	93
McCarthy, P. & Son, Eujinyn	Nabawa ...	35	22	13	14	8	92
Cook, H. F., Tammin ...	Nabawa ...	33	24	13	13	9	92
Barton & Son, North Baandee	Gluyas L.	32	23	14	13	9	91
Hewton, A. W., Minnivale ...	Nabawa ...	33	23	13	13	9	91
Woolgar, W. G., Merredin ...	Nabawa ...	30	22	13	14	8	87
Creagh Bros., Nungarin ...	Gluyas E.	29	22	14	13	9	87
Teasdale Bros,. Merredin ...	Merredin ...	30	23	12	13	8	86
Murray, B. L., Doodlakine ...	Gluyas E.	35	18	13	12	8	86
Warner, F., Nungarin ...	Gluyas E.	28	20	14	13	8	83
Meakin & Son, Tammin ...	Nabawa ...	26	23	12	13	8	83
McLellan, J., Kellerberrin ...	Nabawa ...	24	20	13	12	8	77
			Zone 2.				
Ackland, R. B., Wongan Hills	Nabawa ...	35	23	14	13	8	93
McLean, J., County Peak, Beverley	Nabawa ...	35	20	13	14	8	90
James, L. & H., Kondinin ...	Nabawa ...	30	22	14	14	9	89
Hebiton, J. K., Three Springs	Gresley ...	31	23	13	12	9	88
Bowen, T., Wongan Hills ...	Federation	34	20	12	12	9	87
Trotter, H., Gnarming ...	Qn. Fan ...	28	23	13	13	8	85
Carter & Sons, Three Springs	Niloc ...	35	20	11	11	8	85
Lukin, G., Calcarra	Major ...	34	*18	12	12	9	85
Vanzetti, Mrs., Marchagee ...	Nabawa ...	23	21	13	13	6	76
Locke, J. H., Pithara ...	Nabawa ...	21	17	13	13	7	71

* Deductions: 2 points, third crop.

			Zone 3.				
Clifford, Michael, Gilliminning...	Federation	35	†20	13	13	8	89

† Including a deduction for second crop of 4 points.

Mr. Michael Clifford, of Gilliminning, was the only competitor in the late zone. His was an exceedingly fine crop of "Federation," well worthy of the honour it won, though without competition. The report of the judge, Mr. W. P. Cass-Smith, states:—"The crop was very tall and thick, the heads being well filled out. The land on which the crop was grown carried in the virgin state jam, wattle, manna, and white gum timber. It was ploughed in July with the mouldboard to a depth of five inches, cultivated after ploughing, and again, before seeding, with the springtyne cultivator. Sowing took place in May, 75lbs. and 120lbs. being the respective rates of seed and superphosphate.

It is to be sincerely regretted that there was so little competition in the third or late zone for, whilst wheat-growing may not be the prime importance it is in the other two zones, it has a place in the farm cropping and,

it is believed, a place which will increase in importance. Further, the very friendly and often keen rivalry brought about by these competitions, improves not only the methods connected with the production of wheat but also the farm practice generally. Because of this latter important factor, the question of changing the form of competition in this Zone will require to be considered if the lack of response to the present competition continues.

In the early and mid-season zones the response has been good, and there is very keen competition.

As provided by the conditions of the competition, all crops are on fallowed land, the methods adopted by the competitors for the ploughing and cultivation of this land being remarkably similar. There is a general tendency to carry out the initial operation early in the winter so as to ensure storage of all the winter rains possible, and in consequence the work of ploughing for the competition crops is invariably completed not later than July. One competitor, Messrs. P. McCarthy & Son, of Eujinyn (Bruce Rock), followed the Wimmera practice of summer fallowing, and carried out the initial operation in March. In only one instance was the depth ploughed less than four inches, the usual depth being between four and four and a-half inches.

In order to check the loss of stored moisture all the fallowed land was cultivated in early spring, followed by such subsequent cultivation as each competitor deemed necessary for the preparation of a good seed-bed. Having due regard to the rainfall and soil, the cultivation of the fallowed land by the different competitors is remarkably similar, in that the fallowed land is worked at least three times, that is, twice in the spring and immediately before seeding.

If the ground is not too hard and is fairly free from weeds, the ploughed land is usually first worked in September with a springtyne cultivator, but if hard or weedy it is turned back with a skim plough, disc cultivator, or "Sundercut." Following on the cultivation in September it is invariably cutlivated again in October with the springtyne and then left until the harvest, or in some cases, until planting time, when in most cases the ground is finally stirred with the cultivator or cultivator and drill combined. Several competitors also use the cultivator between harvest and sowing time in order to destroy weeds or break any crust formed by rain. Any slight variations in the procedure are due to a realisation of the fact that no hard and fast rule can be formulated as to how often the fallowed land must be worked. No good purpose is served by working the fallowed land unless for the destruction of weeds or to renew the soil mulch. The number of cultivations given must necessarily be governed by the character of the soil, the climatic conditions, and the weed growth. The object to be achieved is a seed bed free from weeds covered by a shallow mulch protecting a compact layer beneath from evaporation.

The popular variety is undoubtedly "Nabawa." In No. 1 Zone this variety was planted by nine competitors, including the winners. "Gluyas Early" was planted by three, and "Merredin" and "Gluyas Late" by one each. In No. 2 Zone there were five competitors, including the winners, who used "Nabawa" and "Federation;" "Gresley," "Queen Fan," "Niloc," and "Major" were used by one each.

There is not the same uniformity with regard to the rate of seeding as there is with regard to the preparation and cultivation of the fallowed land. In No. 1 Zone eight, including the winners, used 40 to 50 lbs., and six, 60 to 70 lbs. In No. 2 Zone one competitor used 45 to 50 lbs. seed, and the others used from 50 to 60 lbs. All competitors apply superphosphate at the time of sowing. The majority in both zones use from 70 to 90 lbs. In No. 1 Zone the winners used 110 and 90 lbs. respectively. In No. 2 Zone the winners used 60 lbs.

There is an undoubted tendency to plant later than was the custom some years ago, when the best month for planting was considered to be April. Only four competitors planted in this month, the majority of the remainder planted in May, and one competitor waited until June. May is, undoubtedly, the favourite month for seeding, and this preference is obviously well founded.

The competing crops were very free from disease, only traces of any being found. The presence of small patches of "take-all," however, in many of the crops in both zones is evidently a legacy of the "crop and fallow" period, and is the warning note now being sounded to change to the three-course system and to the introduction of oats into the cropping system in a regular and systematic manner.

The average yield of the 14 competing crops in the early zone was 32 bushels, and of the 10 entrants in the mid-season zone, 30½ bushels; the yields of the winning crops in each case exceeding 35 bushels. These yields must be regarded as extremely satisfactory, despite the fact that the season, though marred by a dry September, was undoubtedly good, and was crowned by unusually good rains after the middle of October. It was only possible for the competitors to derive full advantage of these late rains because of the good methods adopted, which enabled the crops to withstand the dry spell and carry on until the rains came.

The yields obtained are far beyond what were the expectations of the farmers in the early days of the settlement of these districts, and will prove a stimulating encouragement for the future.

Though the difference in the climatic conditions of different seasons makes comparisons difficult, it is interesting to note the variation in the average yield of the crops in this competition since its initiation. The average yields for the different years are:—1921, 25 bushels; 1922, 24 bushels; 1923, 29 bushels; 1924, 31 bushels.

There is distinct evidence that these competitions are bringing about uniformity of methods amongst the competitors, and largely following along the lines practised by the winners. The other farmers will follow the lead given by the competitors, and their methods must inevitably be improved. The undoubted effect of the Royal and district competitions will be, therefore, to standardise farming practice, and in the direction of better methods and higher yields.

FIELD EXPERIMENTS WITH WHEAT AT THE CHAPMAN EXPERIMENT FARM, 1924.

I. THOMAS,

Superintendent of Wheat Farms.

The season experienced was an excellent one. The rainfall, though five inches less than the previous year, was in every way better, being more evenly distributed, and continued later in the season. The monthly details of the rainfall are shown below, together with those of the previous year.

—					Growing Period.						Total.	—		Total for year
Year.	Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	In May-Oct.	Nov.	Dec.	Points.
1923	22	16	45	91	144	1,250	207	181	138	68	1,988	...	10	2,172
1924	...	1	115	15	173	418	292	296	158	156	1,493	53	3	1,680

From the above figures it will be seen that the heavier rainfall of 1923 was due to the excessive amount of 1,250, recorded in June, and which was injurious rather than beneficial. The good rains recorded throughout October this year were most beneficial.

The land on which the experiments were carried out was what may be classed as good second-class country, from which jam trees had been cleared some years previously.

All the experiments were planted on fallowed land. The initial ploughing was commenced in late June, and was completed early in August, 1923, and was afterwards cultivated with a 'Springtyne" implement when required to destroy weeds and conserve moisture.

In the soil-mulching experiment the cultivations given to the respective plots were in accordance with the requirements of the experiments. The other experiments were cultivated after ploughing again in October, in February or March, and finally prior to planting. Except the early section of the seasonable planting experiment which, in accordance with the requirements had to be sown in April, the planting of all the other experiments did not take place until after the autumn rains had set in on 11th May.

Rate of Seeding Experiment.—This was continued as in the previous years. Superphosphate was supplied at the rate of 150lbs. per acre. The results for this year and the average for the two years are as hereunder:—

RATE OF SEEDING EXPERIMENT, 1924.

HAY YIELDS.

Late Variety "Yandilla King," planted 15th May.

Rate of Seeding per acre.	Computed Yields per acre. Section 1.	Section 2.	Section 3.	Average 1924.	Percentage 1924.	Average 1923.	Average 1923–24.	Percentage 1923–24.
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	C. Q. L.	C. Q. L.	%
60lbs.	23 2 8	30 0 16	29 0 0	27 2 8	80	29 3 4	28 2 20	92
45lbs.	35 3 4	32 0 16	34 3 4	34 0 26	100	27 3 23	31 0 10	100
90lbs.	31 3 4	31 0 24	28 3 20	30 2 16	89	28 3 1	29 2 22	95
Early Variety "Florence," planted 17th May.								
60lbs.	25 0 8	23 3 4	27 0 24	25 1 12	94	15 0 27	20 1 6	100
45lbs.	27 1 12	24 2 0	28 2 8	26 3 6	100	13 3 7	20 1 7	100
90lbs.	30 0 0	29 1 12	30 2 8	29 3 29	112	18 3 1	24 1 13	120

GRAIN YIELDS.

Late Variety "Yandilla King," planted 15th May.

Rate of Seed per acre.	Computed yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average 1924.	Percentage 1924.	Average 1923.	Average 1923–24.	Percentage 1923–24.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	bus. lbs.	%
60lbs. ...	18 48	16 40	13 28	14 40	13 36	15 26	92	28 48	22 7	98
45lbs. ...	18 8	16 56	15 12	16 32	16 32	16 40	100	28 19	22 29	100
90lbs. ...	17 12	17 4	16 0	14 24	14 16	15 47	94	27 33	21 40	96
Early Variety "Florence," planted 17th May.										
60lbs. ...	15 44	13 4	14 0	17 4	18 56	15 46	107	18 37	17 11	105
45lbs. ...	14 40	13 26	12 24	14 32	18 24	14 42	100	17 46	16 14	100
90lbs. ...	15 28	14 48	13 28	18 8	20 0	16 22	112	18 26	17 24	107

The results of the two years' experience indicate that, with a late free-stooling variety, there is no advantage in using more than 45lbs. of seed either for grain or hay. With an early sparse-stooling variety, however, heavier seeding is desirable for hay purposes.

RATE OF SUPERPHOSPHATE EXPERIMENT.

This experiment was commenced last year, three plots being seeded at 60lbs. per acre.

Table hereunder shows the results for this year, and the average for the two years:—

RATE OF SUPERPHOSPHATE EXPERIMENT, 1924.

Variety "Nabawa," planted 14th May, 1924.

HAY YIELDS.

Rate of Superphosphate per acre.	Computed Yields per acre. 1.	2.	3.	Average 1924.	Percentage 1924.	Average Yields 1923.	Average 1923–24.	Percentage 1923–24.
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	C. Q. L.	C. Q. L.	%
150lbs.	26 1 12	23 1 24	22 2 24	24 0 13	110	24 2 27	24 1 20	116
75lbs.	23 1 4	20 1 4	22 0 24	21 3 20	100	19 3 17	20 3 19	100
225lbs.	23 1 4	20 2 24	*	22 0 0	100	28 2 10	25 1 5	120

* The yield was so obviously affected by outside sources that it was unsuitable for comparison, and therefore discarded.

GRAIN YIELDS.

Rate of Superphosphate per acre.	Computed yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average 1924.	Percentage 1924.	Average Yields 1923.	Average 1923–24.	Percentage 1923–24.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	bus. lbs.	%
150lbs. ...	19 55	22 24	22 32	21 28	22 48	21 50	106	21 4	21 27	109
75lbs. ...	20 0	20 48	20 48	20 24	21 4	20 37	100	18 34	19 36	100
225lbs. ...	21 28	21 55	22 0	22 16	21 44	21 53	106	21 23	21 38	110

To date the results indicate that the yields of both grain and hay are increased by the application of the larger amounts of fertiliser.

LATE SEEDING EXPERIMENT.

This experiment, as in last year, was planted so that the plots were seeded about the middle of May, June, and July respectively. The area of each plot was one-eighth of an acre, and repeated three times.

During early December a fire started on an adjoining farm, spread to the farm and destroyed a large area of the standing crop, including this experiment. In consequence no yields for this year are available. Fortunately a photograph of this experiment was taken in early October, and the effect of the later planting may be judged from the illustration herewith, made from that photograph.

After the photograph was taken good rains enabled the June and July plantings to mature under favourable circumstances, but from observations it did not appear as if either would equal the yield of the May planting. The July planting was considerably below that of the June planting.

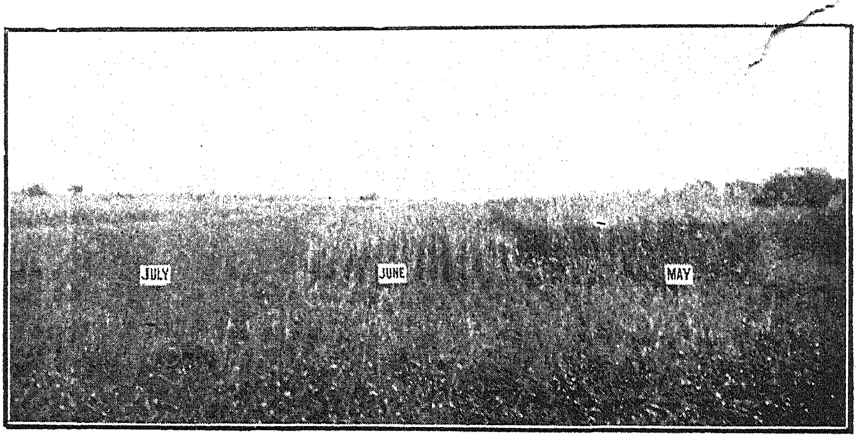
The results of last year's planting are shown hereunder. These show that May is the best month for planting in this district.

TABLE C.—LATE SEEDING EXPERIMENT, 1923.

Variety: Gluyas Early.

Seed, 45lbs. per acre. Superphosphate, 112lbs. per acre.

Planted.	Computed Yields.			Average.	Per cent.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
May 15th	20 30	21 29	24 34	22 11	100
June 12th	18 31	18 16	16 12	17 40	79
July 10th	12 50	15 48	15 10	14 36	66



Late Seeding Experiment, Chapman Experiment Farm, 1924.

FIELD EXPERIMENTS WITH WHEAT AT THE MERREDIN EXPERIMENT FARM.

J. H. Langfield, Farm Manager.

The season was good; light rains came at opportune times and kept the crops growing. The rainfall, however, was not heavy enough to provide moisture reserves in the soil, and in consequence a very anxious time was experienced because of the scarcity of rain in September. This was eventually offset by the good rains which fell after the middle of October.

The results of last year's planting are shown hereunder; these show that May is the best month for planting in this district:—

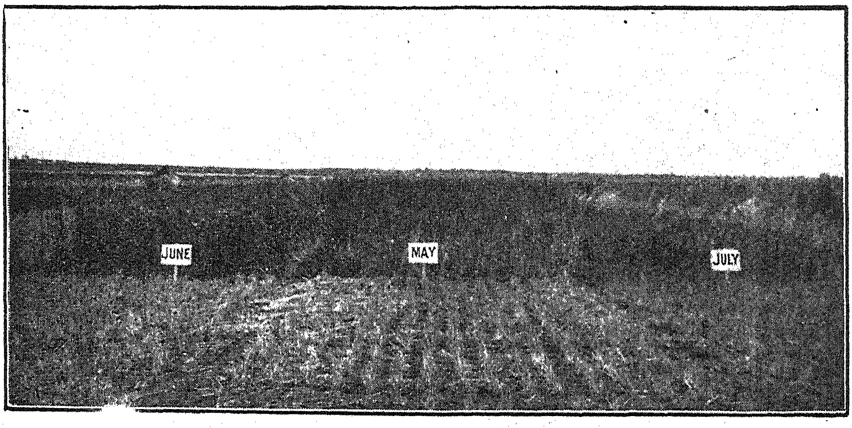
MERREDIN EXPERIMENT FARM.

Rainfall (1924) in points.

Jan.	Feb.	Mar.	April.	Growing Period.						Total. May-Oct.	Nov.	Dec.	Total for 1924.
				May.	June.	July.	Aug.	Sept.	Oct.				
Nil	38	70	46	177	200	94	179	89	154	893	47	7	1,101

LATE SEEDING EXPERIMENT.

The object and other particulars relating to this experiment were published in the April issue of this *Journal*. The experiment was first conducted in 1923; and this year's results are very similar to those obtained last season,



Late Seeding Experiment, Merredin Experiment Farm, 1924.

which go to prove that in districts with climatic conditions similar to Merredin, the yield from wheat sown later than May has a gradual decline.

This season the splendid rains that fell during October suited the late-sown crops, and the good yield of the July planting is mainly due to this.

The yields of both the June and July plots are better than should be expected in an average year, when the rainfall is usually light during the month of October.

The land for this experiment was fallowed in June, cultivated in September, and worked to a good seed-bed before planting. The June plot received one and the July plot two cultivations after the May plot was sown; all plots were harrowed after the drill.

The variety of wheat used was Gluyas Early, and was seeded at the rate of 60lbs. per acre, superphosphate being applied at the rate of 112lbs. per acre.

The results obtained this year, together with the two years' average, are as follow—

MERREDIN.

Late Seeding Experiment, 1924.

GRAIN YIELDS.

Time of Seeding.	Computed yield per acre. Section 1.		Section 2.		Section 3.		Average 1924.		Percentage 1924.	Average 1923.		Average 1923–24.		Percentage 1923–24.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	bus.	lbs.	%
June 16th ...	27	28	27	44	28	48	28	0	90·5	27	33	27	24	85·2
May 17th ...	30	32	30	32	33	4	30	56	100·0	34	13	32	32	100·0
July 14th ...	20	16	20	10	20	16	20	8	65·1	15	47	17	52	55·0

RATE OF SUPERPHOSPHATE EXPERIMENT.

This experiment was first conducted in 1923, and the results this year are very similar to those obtained last season.

The experiment was carried out on heavy salmon gum and gimlet country; it was fallowed in June, cultivated with a springtooth cultivator in September, the disc cultivator was put over it in March, and it was harrowed after early April rains in order to conserve moisture and assist in germinating weeds. It was again cultivated with a springtooth cultivator before planting to bring it to a good seed-bed.

It was planted on 7th May with 60lbs. seed, and superphosphate at the rate shown on the table.

Soon after germination the plots that received the heavier dressings of superphosphate showed the more vigorous growth, and this was maintained up to the time the crop came into ear, the plots receiving 225lbs. superphosphate appeared thicker and to produce more foliage, whilst the 150lb. plot was thicker and more vigorous than the one receiving 75lbs. The rate of application also influenced the maturity of the crop, the heavier the dressing the earlier did the crop mature. The more heavily manured plots were also inclined to lodge much more than the lighter ones. This may have been due to the heavier growth of flag and straw which they carried.

The results this season show a decided increase for the additional fertiliser when applied to the hay crop, an extra 75lbs. producing 25 per cent. more hay, whilst an extra 150lbs. produced 31 per cent. more. The difference

is not so great with the grain crop, the extra 75lbs. of superphosphate producing eight per cent., and the 150lbs. extra produced 17 per cent. more. When this year's results are averaged with those of last season, they show an increase of 14 per cent. of 75lbs. of extra superphosphate and 18 per cent. for 150lbs. extra in the hay yield; whilst in the grain yield the increase is 10 and 15 per cent. respectively.

From results already obtained it indicates that an increase in yield of both hay and grain is obtained from the increased quantity of superphosphate, and whilst in some seasons it may pay to increase the quantity to two cwt., our results to date go to show that the most economical dressing would be 150lbs.

The detailed results, together with the average for the last two seasons, are given herewith:—

MERREDIN EXPERIMENT FARM.

Rate of Superphosphate, 1924.

GRAIN YIELDS.

Rate of Superphosphate per acre.	Computed yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average 1924.	Percentage 1924.	Average 1924.	Average 1923–24.	Percentage 1923–24.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	bus. lbs.	%
150lbs.	28 32	30 24	32 16	30 32	32 0	30 40	108·5	34 33	32 41	110·1
75lbs.	28 56	28 8	29 4	28 32	26 32	28 16	100	31 4	29 40	100
225lbs.	32 40	34 56	34 40	31 36	32 8	33 12	117·4	35 18	34 15	115·4

HAY YIELDS.

Rate of Superphosphate per acre.	Computed yield per acre. Section 1.	Section 2.	Section 3.	Average 1924.	Percentage 1924.	Average 1923.	Average 1923–24.	Percentage 1923–24.
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	C. Q. L.	C. Q. L.	%
150lbs.	68 0 0	72 2 16	66 2 24	68 1 20	125	56 2 17	62 2 4	114·4
75lbs.	55 2 44	55 0 24	53 0 24	54 2 24	100	54 2 5	54 2 14	100
225lbs.	73 3 20	72 1 4	70 1 4	72 0 16	131·9	57 0 11	64 2 13	118·2

RATE OF SEEDING EXPERIMENT.

As in previous years this experiment was carried out with two varieties —a free-stooling mid-season and a sparse-stooling and early variety.

The rates of seed were 30, 45, and 60 lbs. per acre in both cases. The land was fallowed in June, cultivated in September; it was worked to a good seed-bed before planting. Superphosphate was used at the rate of 84 lbs. per acre; this being the same as applied to the main crop. The varieties of wheat used where "Nabawa," to represent a free-stooling variety, and "Florence," to represent a sparse-stooler; the plots are repeated eight times, three being harvested for hay and five for grain.

Details of the results of this years' experiments will be seen in the following table:—

MERREDIN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT, 1924.

GRAIN YIELDS.

Midseason Variety "Nabawa," planted 27th May, 1924.

Lbs. of Seed per acre.	Computed yields per acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average 1924.		Percentage 1924.	Average previous years.		Average 1913–24.		Percentage 1913–24.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	bus.	lbs.	%
30lbs. ...	29	36	30	32	31	12	32	40	31	28	31	4	98·7	19	55	20	55	95·0
45lbs. ...	31	28	31	36	30	32	33	4	30	48	31	28	100	21	4	22	1	100·0
60lbs. ...	29	52	31	28	32	24	34	8	32	8	32	0	101·7	20	40	21	42	98·6
Early Variety "Florence," planted 29th May, 1924.																		
30lbs. ...	22	24	22	48	23	20	24	8	26	8	23	44	96·7	20	43	20	59	97·6
35lbs. ...	22	32	22	16	23	36	25	52	28	40	24	32	100	21	12	21	30	100·0
60lbs. ...	21	52	24	8	25	28	26	32	27	28	25	4	102·1	21	7	21	29	100·0

The heavier seeding gave practically no better results from either the sparse or free stooling varieties. In the hay section the 45lbs. rate gave the best yields, but here again by a narrow margin only.

Rate of Seeding Experiment, Merredin Experiment Farm, 1924.

Experiments conducted by the Chapman Experiment Farm, and also by many farmers, include a rate of seeding experiment, the different rates of seeding of which are 45, 60, and 90 lbs. per acre. To make uniformity in this respect the Merredin Experiment Farm enlarged their experiment to

include these rates of seeding; the mid-season variety "Nabawa" only being used. The tabulated results of the experiment are hereunder:—

RATE OF SEEDING EXPERIMENT, 1924.

Midseason Variety, "Nabawa," planted 17th April, 1924.

GRAIN YIELDS.

Lbs. of Seed per acre.	Computed Yield per acre.										Average 1924.		Percentage 1924.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
60lbs.	26	40	29	20	31	20	29	28	30	48	29	28	103·7
45lbs.	25	28	29	12	29	4	28	32	30	8	28	24	100·0
90lbs.	28	24	32	16	28	56	31	28	32	0	30	32	107·5

HAY YIELDS.

Lbs. of Seed per acre.	Computed Yield per acre.									Average 1924.			Percentage 1924.
	Section 1.			Section 2.			Section 3.						
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	%
60lbs.	42	1	4	43	0	0	47	0	8	44	0	8	98·8
45lbs.	44	0	0	43	3	4	46	0	8	44	2	8	100·0
90lbs.	44	1	20	46	2	24	46	1	4	45	3	4	102·6

It will be noticed that the heavier quantities of seed gave slightly better results. This may have been due to its being sown early, thus allowing for a longer period for stooling and development. This is not in accordance with the generally accepted theory amongst farmers, who usually advise increasing the amount of seed for later planting.

FOREST PESTS.

The Pin-hole borer (Atractocerus Kreuslerae, Pasc.)

J. CLARK, F.L.S.,
Assistant Economic Entomologist.

Probably no insect does greater damage to the commercial timber growing in Western Australian forests than the pin-hole borer.

Although only too well known in the larval state, the imago, or adult stage, of this insect has only lately been discovered. Various attempts have been made to rear the larvæ to maturity, both in the laboratory and in the field, but all attempts to do so failed until January of the present year.

For some years it has been the aim of the Entomological Branch to capture these beetles by means of fine brass-wire gauze traps nailed securely over a portion of various trees containing pin-hole borers, but until recently little success attended these efforts, owing mainly to bush fires and inquisitive, or mischievous, individuals who destroyed the traps.

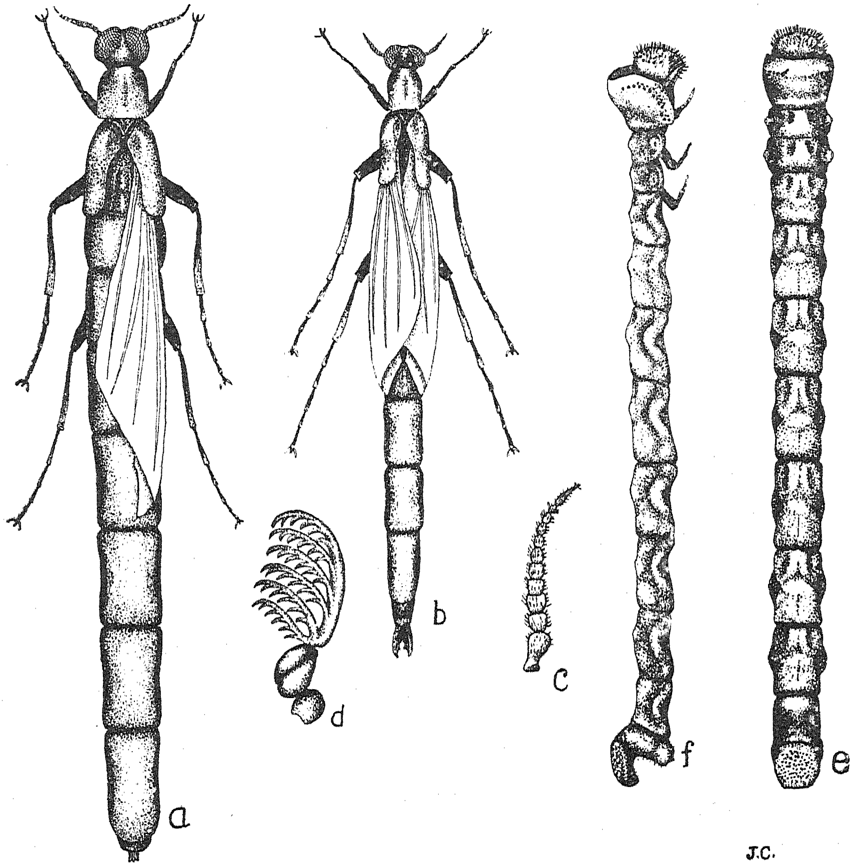
In February of last year traps in the Mundaring district were examined, one was found to contain a large amount of insect remains and several small, empty, pupal cases. The remains of the insects were so fragmentary, owing to the ravages of small Ants (*Pheidole*), as to render their identification impossible, but from the appearance of the long thin legs, palpi and pupal cases, it was considered that these were the remains of small boring moths. The trap had been attached to the tree for 12 months, and except for the very small ants, no insects could enter without emerging from the larval burrows. As all our traps on this area were about this time destroyed by a disastrous bush fire, our efforts were centred on pin-hole borer traps attached to Tuart trees on the Ludlow Tuart Reserve.

Four traps were attached to trees containing very active colonies of borers in May, 1923, and were kept under observation as much as possible, efforts being made to examine them at regular intervals. During the later part of last year it was found that one of these traps had been torn off, but the other three were intact and the larvæ working strongly.

On my last visit to these traps in the middle of January this year, I was surprised to find that the area containing the traps had been burned out, and that the two lower traps had been badly burned, but the upper trap appeared not to have been touched by the fire. An examination of the undamaged trap revealed two live and remarkable beetles, the adults of the pin-hole borer. These belong to the wood-boring family *Lymexylonidae*, and have been identified, with little doubt, as *Atractocerus Kreuslerae* (Fig. I, a, b). The trap was removed from the tree, and, with the aid of an axe I was able to obtain a large number of the insect in various stages of development, but the majority had left the pupal case and were lying at the front edge of the burrow ready to emerge. Having cut out all that were covered by the trap, I explored many trees in the district which contained pin-hole borers, and had the satisfaction of finding the adults present in every case.

This is the first record of this insect being so numerous in this State, although there is at present a single female in the Western Australian Museum, taken at Guildford in 1915. During January of the present year

Mr. L. J. Newman captured a single male example near Claremont, on reeds. It seems remarkable that an insect whose larvæ is so abundant in our trees should be so rare and practically unknown in our State collections, but from observations of this beetle, during January of this year, it is not surprising that it remained so long unknown. The perfect beetle, unlike most



A.—*Atractocerus Kreuslerae*, Pasc; female, enlarged; one wing removed to show segments.
B.—*Atractocerus Kreuslerae*, Pasc; male, enlarged.
C.—Right antenna of the male, greatly enlarged.
D.—Right palpus of the male, greatly enlarged.
E.—Dorsal view of larva, enlarged.
F.—Lateral view of larva, enlarged.

insects, does not wait outside the burrow for its wings to harden in order that it can fly away, it flies off at the moment it is clear of the entrance and sails right up to the top of the tree so quickly that one can scarcely watch it go.

When on the wing this beetle is remarkably like one of the small Neuropterus insects, and even at rest it is easily mistaken for a May Fly or other Neuropteron.

The family to which this beetle belongs is world wide in its distribution, but is most abundant in the tropics. Eight species have been described from Australia and Tasmania, but so far as I can find nothing has been published regarding their life history, except perhaps, a small note by Mr. A. M. Lea, in which he says, of *Atractocerus victoriensis,* "three specimens were taken

Portion of tree trunk infested with the pin-hole borers.

out of piles in the Moe River, at Yarragon, by Mr. W. Kershaw." Most of the species appear to have been captured at lights at night.

The type of the present species was described by Pascoe in 1864, from specimens captured in South Australia, but nothing was known regarding its habits, the following notes may therefore be of interest. The eggs are deposited on the bare injured timber of the tree, generally on the seat of an old blaze mark, or in gaps cut into the trees by wood cutters, or where limbs have been torn off. Almost any Eucalypt in the bush with a portion of the trunk injured is liable to attack, but the species of trees are favoured in the following order:—Blackbutt (*Euc. patens*), Tuart (*Euc. gomphocephala*), Jarrah (*Euc. marginata*), Wandoo (*Euc. redunca, var. elata*), Flooded Gum (*Euc. rudis*), Marri (*Euc. calophylla*). A striking feature in connection with the borer and the Tuart is that it is frequently found working in old stumps and old logs lying on the ground. I have not found this to be the case with the other trees, although on rare occasions I have seen the borer active in dead Wandoo, which was still standing with suckers attached.

The larvæ, which measures up to 35 m.m., or 1½ inches, is of a light cream colour, with the head and cowl yellowish. A few short, erect, yellowish hairs on the head, cowl, and terminal segment of the body, longer and bristle-like on the legs, the rest of the body without hairs.

Head small, rounded above and on the sides; the mandibles long and sharply pointed; eyes absent; antennæ vestigial; three-jointed; palpi long and broad, with a row of large bristle-like hairs on the inner edge. The first segment of the body is raised and produced upward and forward somewhat in the form of a cowl; on the sides near the front edge there is a row of raised punctures, these are effaced on top. The second and third segments are short, much shorter than the others, and have on each side a strong tubercule on the apex of which the spiracles are placed. The peculiar wrinkling of the fourth to the tenth segments give the appearance in many examples as though the segments were double, in some examples the wrinkles are feeble. The terminal segment is the most remarkable, this is strongly raised upward and arched backward, with the top flat, and pitted with moderately large punctures; this segment can properly be termed hook-shaped; in front below the segment is produced downward with the bottom edge broad, the anus is placed in the middle of this edge. There is a faint indication of a joint about one-third of its height from the bottom. The legs are somewhat rudimentary, and are armed with one strong sharp claw; the legs are of no use to the insect when placed on a flat surface, but no doubt would be of much use in assisting its movements in the burrow, they appear to be fixed in a forward direction, and to possess little power of movement.

The larvæ bore for a considerable distance into the tree, mostly in a horizontal direction, but frequently upwards or downwards, and very often in all directions.. As the larvæ progress inwards they continualy push out a long thread-like core, which is usually projecting about one inch from the burrow, eventually breaking off and accumulates in a heap at the base of the tree, or the injured portion; this thread-like core is very characteristic of the pin-hole borer. No doubt the peculiar terminal segment is adapted for ejecting this material, the short forward-bent legs giving it great power to push the core along the burrow.

When fully grown the larvæ appears to turn in the burrow and work back to the entrance, the tunnel being greatly enlarged, the core being packed tightly behind as it works along. The entrance to the burrow is plugged and the larva pupates close to the surface, usually from a quarter to half an inch inward. In many cases the pupal case is cast off inside the burrow, but on several occasions I have found the empty case projecting half an inch from the entrance to the burrow. The pupa is enclosed in a transparent envelope, the insect being clearly visible within.

The males are much smaller than the females, but occasionally large males and small females are found. The males recently taken measure from 17 m.m. to 23 m.m., and the females from 25 m.m. to 31 m.m. They are of a dingy brown colour, with the hind wings transparent (Fig. 1, a, b). The eyes are large and close together. The antennæ are short, eleven-jointed, with the last joint longer than the two preceding joints together, it appears to be composed of two joints fused together. The palpi are very large and of peculiar shape (Fig. 1, d); they are much larger in the male than in the female. In the figure only the right half of the right palpus is shown, the terminal pectinations being double. The wing covers are very short, they are three times longer than broad near the base; the hind wings very long and narrow. The legs are long and thin, those of the male being much longer than those of the female; in both sexes they are armed with long sharp claws.

The speed with which this beetle takes to the wing is remarkable, for it is no sooner out of the burrow than it is off. This is greatly assisted by the abnormally short wing covers, and the comparatively long hind wings.

The actual time passed by the larvæ in the tree is not definitely known, but they spend at least two years in the larval state. This fact we know from the traps on the Tuart trees at Ludlow, but the borers had been at work for some time before the traps were attached.

Experiments are now being conducted with a view of obtaining the exact length of time taken to reach maturity from the egg, and for this purpose fertile females have been imprisoned in traps on trees.

No parasites have been observed in connection with this insect, but the larva appears to be liable to the attacks of a fungus which at times fills up the burrow and destroys the insect.

This pest, being so wide-spread and having so many hosts, could not be economically controlled by artificial means.

METEOROLOGICAL INFORMATION.

1924–25.

NOVEMBER, 1924.

Stations.	Temperature. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	81·8	109·5	53·3	40·8	·53	·20
Geraldton	77·8	103·3	58·4	51·0	·38	·25
Walebing	82·2	100·0	50·8	38·2	1·11	·51
Perth	74·7	93·6	55·8	47·8	2·61	·73
Kalamunda	73·6	92·7	54·2	45·3	2·58	1·04
Bunbury	73·4	94·2	53·6	44·8	1·67	1·04
Bridgetown	72·2	90·3	47·9	40·8	2·58	1·12
Albany	67·8	86·0	53·0	46·0	2·48	1·34
Merredin State Farm	81·0	102·0	52·1	42·8	·47	·42
Northam	80·5	101·2	52·5	41·2	·64	·38
York	80·3	98·8	51·9	41·2	·58	·43
Narrogin State Farm	75·3	94·5	47·3	38·4	·79	·59
Katanning	73·0	90·4	48·1	39·0	1·08	·64
Cape Leeuwin ...	66·3	92·0	57·6	51·0	2·73	1·23

DECEMBER, 1924.

Stations.	Temperature. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	...	...	63·0	52·4	·03	·18
Geraldton	86·6	112·0	64·7	52·4	·05	·13
Walebing	90·3	108·0	60·3	51·0	·25	·47
Perth	83·2	96·6	60·3	49·3	*Nil*	·59
Kalamunda	84·9	99·6	57·9	45·4	*Nil*	·94
Bunbury	81·3	90·2	56·1	44·5	·06	·61
Bridgetown	81·4	95·2	50·3	37·8	*Nil*	·82
Albany	71·7	81·0	56·6	51·0	·23	1·13
Merredin State Farm	89·8	104·9	59·8	45·6	·07	·72
Northam	91·3	108·8	60·4	49·3	*Nil*	·37
York	91·0	108·6	58·5	47·0	*Nil*	·46
Narrogin State Farm	84·9	101·0	53·1	39·4	·52	·58
Katanning	82·1	101·0	52·1	41·3	*Nil*	·55
Cape Leeuwin ...	71·7	83·2	60·9	55·0	·09	·93

JANUARY, 1925.

Stations.	Temperature. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	91·4	105·0	62·6	52·4	·35	·31
Geraldton	84·2	101·0	65·6	55·0	·54	·23
Walebing	87·8	109·2	59·8	45·3	·83	·34
Perth	83·3	95·0	61·4	48·6	·65	·35
Kalamunda	82·9	97·6	58·8	47·0	·80	·54
Bunbury	82·6	93·8	57·6	44·2	·60	·45
Bridgetown	81·6	98·9	52·3	38·0	1·06	·55
Albany	72·9	91·6	59·4	49·0	1·50	·73
Merredin State Farm	84·1	106·1	59·1	45·0	2·35	·55
Northam	87·7	107·5	60·4	45·1	1·85	·27
York	87·3	108·1	59·1	43·8	1·97	·30
Narrogin State Farm	82·6	104·5	54·6	42·3	·63	·33
Katanning	80·9	103·1	53·8	41·0	·41	·38
Cape Leeuwin ...	74·2	79·0	63·3	50·0	·79	·67

LIVE STOCK AND MEAT.

For the information of readers of the *Journal*, the following particulars have been supplied by Elder, Smith & Co., Limited, Perth:—

Comparative Yardings of Stock at Metropolitan Fat Stock Markets during months of December, 1924, and January and February, 1925.

—	December, 1924.				January, 1925.				February, 1925.			
	3.	10.	17.	30.	7.	14.	21.	28.	4.	11.	18.	25.
Sheep & Lambs	10,047	9,573	14,367	8,859	20,540	17,160	11,874	12,144	7,864	7,906	8,162	7,931
Cattle	644	744	872	634	717	747	496	606	607	610	531	592
Pigs	428	525	10,057	551	611	862	777	1,087	792	809	579	770

Comparative Values of Stock sold at Metropolitan Fat Stock Markets during months of December, 1924, and January and February, 1925.

—	December, 1924.				January, 1925.				February.			
	3.	10.	17.	30.	7.	14.	21.	28.	4.	11.	18.	25.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Mutton ...	0 11	0 11¾	1 1	1 0½	1 0½	1 0	0 11¾	1 0	1 0	0 11½	0 11	0 11
Beef	0 7¾	0 7¾	0 7¾	0 7¾	0 7½	0 7¼	0 7½	0 7¾	0 7¾	0 7¾	0 7¾	0 8
Pork	0 11½	1 0	0 11½	1 0	1 0¼	1 0¼	1 0¾	1 0½	1 0	0 11½	0 11½	0 11½
Bacon	0 10	0 10	0 9¾	0 9¾	0 10	0 10¼	0 11¼	0 11	0 10¾	0 10¾	0 10¾	0 10½

In the comparative yardings of stock it is interesting to note the high figures quoted for the month of January, the sheep and lambs on the 7th and 14th being 20,540 and 17,160 respectively, which, it is understood, constitute record dealings.

MARKET REPORT.

Wheaten Chaff.—The following particulars of the approximate quantity of both wheaten and oaten chaff at the Metropolitan Chaff and Grain Auction Sales, held in Perth during the months of December, January, and February, also the minimum and maximum prices ruling for f.a.q. to prime quality wheaten chaff during those months, have been kindly supplied by Messrs. H. J. Wigmore & Co., Perth:—

December: Quantity—2,450 tons.
Minimum price for f.a.q. to prime—£5 12s. 6d. per ton.
Maximum price for f.a.q. to prime—£6 15s. per ton.

January: Quantity—1,900 tons.
Minimum price for f.a.q. to prime—£6 per ton.
Maximum price for f.a.q. to prime—£7 17s. 6d. per ton.

February: Quantity—2,400 tons.
Minimum price for f.a.q. to prime—£6 15s. per ton.
Maximum price for f.a.q. to prime—£7 5s. per ton.

It will be seen that in January supplies were light, the chief reason being the acute shortage of trucks, and on the 14th January the top price of £7 17s. 6d. per ton was obtained. For several days around that date the market was hovering at from £7 5s. to £7 15s. per ton, but towards the end of the month, after repeated application to the Railways to supply trucks, fairly large rakes were put in at various sidings in order to clear up chaff stacked on the ground, and this resulted in an easing in values. However, the truck position again became very acute, and supplies began to dwindle, the market gradually firming, and on the 14th February the market stood at £7 5s. Since then rather better supplies have been arriving, and at time of writing this report (4th March) the value of f.a.q. to prime is from £6 15s. to £7 per ton. Owing to the shortage of trucks stated above, a considerable quantity of chaff stacked at cutters and railway sidings got caught in the recent heavy rains, with the result that considerable damage was done. Practically all the damaged chaff found its way to the Perth market, and for a few days damaged or partly damaged consignments were very hard to quit at low figures.

Oaten Chaff.—Although in December and January supplies were scarce, towards the latter end of February considerable quantities found their way to market, and at time of writing fair average quality is realising around £5 10s. per ton, and mediums from £5 to £5 2s. 6d., with occasionally a prime consignment realising £6 per ton.

Oats.—Supplies have been plentiful, and the market is exceedingly dull, good heavy feeds selling at from 2s. 10½d. to 3s. per bushel.

Wheat.—The highest price obtained under the hammer during the abovementioned period was 7s. per bushel, but at time of going to press the market for f.a.q. is 6s. 6d. per bushel, smutty and inferior samples readily finding buyers at prices according to quality.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

No. 20.—"The Pruning of Fruit Trees." By J. F. Moody. Price 2s. 6d.
No. 46.—"Fruit Packing and Marketing and Exporting of Fruit." By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—"The Poultry Keeper's Manual." By G. Allman. Price 1s.
No. 83.—"Horticulture and Viticulture." By A. Despeissis. Price 2s.
No. 5.—"Fruit Drying." By J. F. Moody. Free.
No. 15.—"Root Rot." By A. J. Despeissis. Free.
No. 49.—"The Feeding of Horses." By Professor Paterson and G. L. Sutton. Free.
No. 57.—"Vermin Destruction." By A. Crawford. Free.
No. 60.—"The Farmer's Clip." By J. J. Mahood. Free.
No. 68.—"Flaying and Treatment of Hides." By R. E. Weir. Free.
No. 72.—"The Potato: Its Cultivation, Pests and Diseases." By G. N. Lowe, L. J. Newman, D. A. Herbert. Free.
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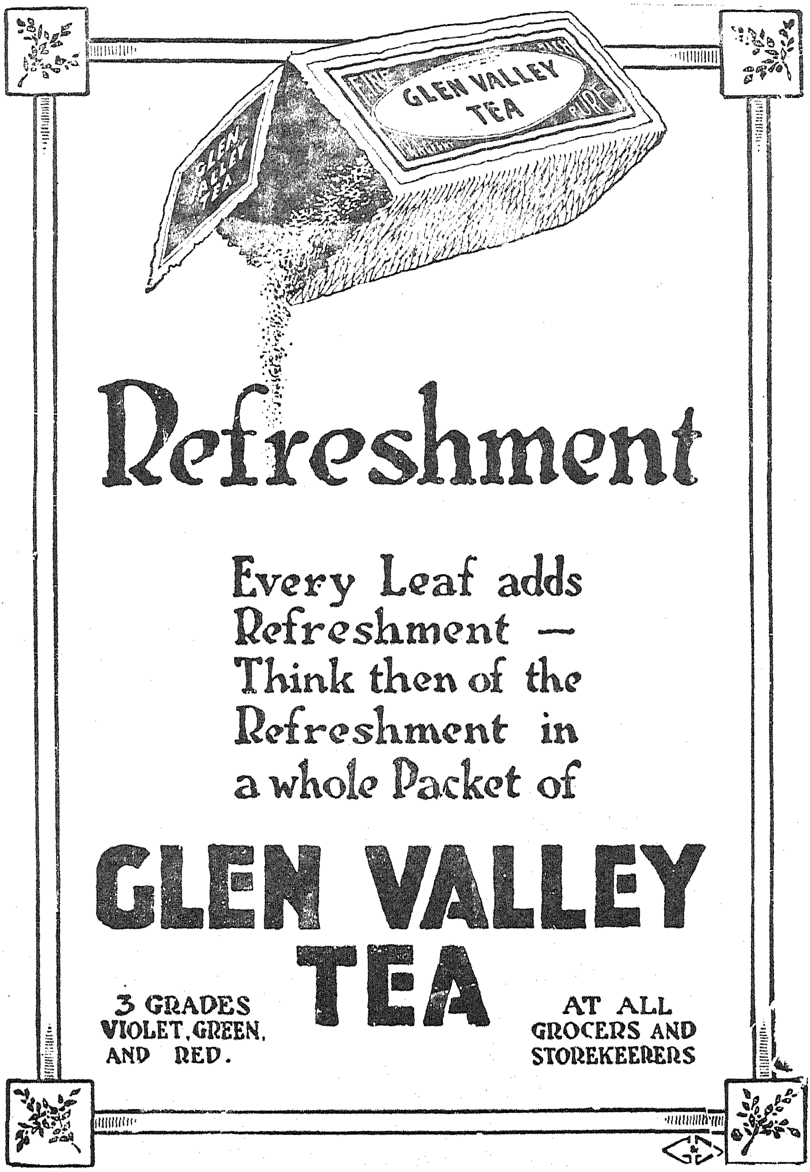
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Refreshment
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AT ALL GROCERS AND STOREKEEPERS

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JOURNAL

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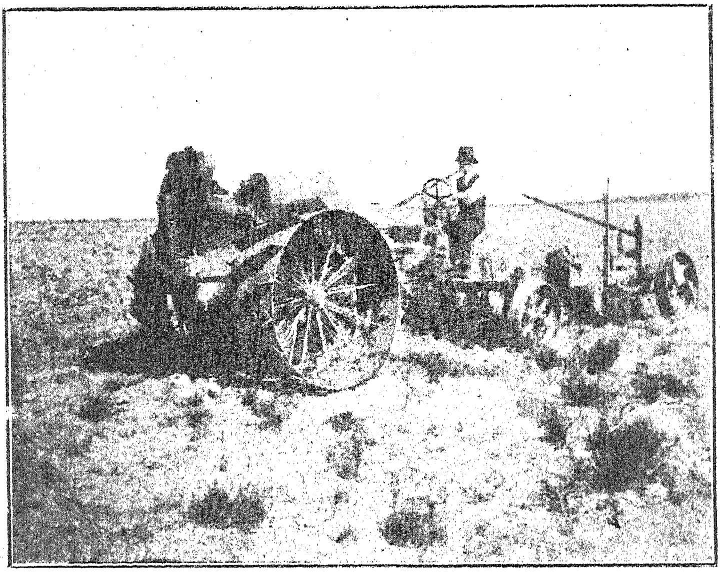
Vol. 2. (Second Series) JUNE, 1925 No. 2.

WONGAN HILLS LIGHT LANDS FARM.

The utilisation of our agricultural lands to their fullest extent is a desideratum that none will gainsay. That a quantity of good land is yet available for selection may be conceded, but most of it is, unfortunately, outside the zone in which it has been considered profitable farming can be pursued; some by reason of its great distance from the nearest railhead or port, and other because situated where an insufficient or irregular rainfall renders the result too speculative. Latter-day progress in motor transport has done much to remove the former disability, but as a remedy it has its limitations. The farmer cannot exact the full productivity of his holding while a too appreciable portion of his time is occupied in the business of a carrier and much of his capital tied up in the essentials for conveyance. The surest proved method of reducing transport expense to its minimum is by community effort, as represented by our railways.

Given large areas of first class land in a favourable climatic setting the provision of railway systems presents little difficulty, and the taxpayer is not unduly burdened by their upkeep. But railways cannot be said to operate successfully when carried through large areas of poorly populated and disused territory, and in this respect Western Australia is under a severe handicap, possessing more miles of railway per head of its population than any other State in the Commonwealth. Compared with other countries Australia, as a whole, shows to disadvantage from this viewpoint. In 1923 there were 4.65 miles of railway laid down to serve each 1,000 of our population. By like comparison Canada had 4.63 miles, while the Argentine, using figures for the year 1920, had only 2.51 miles, and the United States 2.41. But so great was the disparity of our own State that in 1923 we had no less than 13.72 miles of railway per capita thousand—three times as many lines as the average in any other part of the Commonwealth or Canada, five times that of the Argentine, and nearly six times that of the United States. While this makes an excellent showing from the viewpoint of facilities supplied, it also points the fact that our railways are sufficient to serve a much greater population than we have hitherto been able to attract, and, inversely, the taxpayer has to bear a proportionately greater expense. The remedy lies in closer settlement, and can best be effected by converting to use a far greater portion of our native soil. Nature has decreed that most of our alluviums should be what is termed "patchy." We have plenty of rich land, but interspersed with that of an inferior quality.

The light lands are cheap, large areas and fields are therefore possible; they are light to work and therefore large implements can be used, and they can be worked at all times, so that lost time can be avoided. All these factors tend to lower costs of operation to compensate for the lower yields than the forest lands, and help in the profitable utilisation of the light lands.



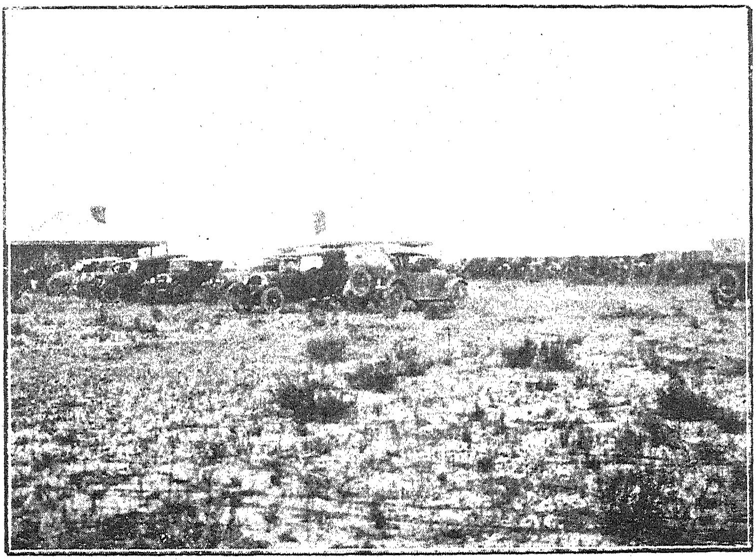
The Minister for Agriculture with the Moline Tractor.

The discussions following the reading of papers submitted disclosed a great diversity of opinion on the method of utilising these light lands. They were, as Mr. Sutton subsequently pointed out, "as varied and as many as the types of light land to be found in the State." But that conference achieved its object, for it was strong in affirming the principle of acquiring definite information on the potential resources of our light land areas. There was a general agreement on the following points: That drainage, fallowing, stock raising, early sowing of suitable varieties of wheat, the application of superphosphate, and inexpensive working methods implying big teams and large areas per man, were essential for the improvement of such areas of land. Their conclusions left three important points to be determined: How water logged lands could be cheaply drained; the most suitable varieties of wheat for such land; and, new varieties of suitable fodder crops for autumn sowing and possible catch crops for summer planting.

Following upon the deliberations of this conference the then Premier (Sir James Mitchell), when bringing down his Budget Speech, obtained approval of Parliament for the establishment of experiment farms on light land. After inspections of various localities had been made by the agricultural experts it was decided, subject to sufficient water supplies being available, to select the Wongan Hills site for the first of these experiments. Fortunately sufficient water for immediate requirements proved available, and in July, 1924, part of the site, comprising 6,683 acres, was dedicated to the Wongan Hills

Light Lands Farm. Under the supervision of Mr. I. Thomas, the Superintendent of Wheat Farms, the area was cleared and burned and prepared for cropping this season. Mr. Jas. Morley has since been appointed manager, and, using two units of motive power, one being an 8-horse team and the other a "Moline" tractor of equivalent strength, 700 acres have been cultivated and 400 acres planted. If at all possible it is hoped to crop 1,000 acres this year.

Such is the genesis of this first practical attempt under State supervision to cope with one of the most important factors conducive to the State's future prosperity. It is estimated that there are some nine million acres of light land in the present wheat belt, and assuming that the work of the light land farm accomplishes its objective and brings these into production within the next decade, what a vast increase in wealth, what a concomitant expansion of industry, population and prosperity may be looked forward to with a reasonable degree of certainty. It requires a good deal of optimism to anticipate such a glorious achievement, but it is not outside the world of possibility. Who can look back upon the wonderful accomplishments of science and human



Visitors' Vehicles Parked.

effort during the past quarter of a century and say this or that great hope is doomed to failure. Our American brothers are wont to talk in millions. It must be admitted that not only do they think and talk on gigantic scales, but what is more to the point, they "arrive." Are we less capable of realising our ambitions; less potent to will to success? Pluck, determination, and a blindness to failure are the great essentials to accomplishment, and who dare say that these qualities are lacking in "the legion that never was listed."

The benefits derived from other experiment farms in the State, and the influence they have had in increased production on the heavier lands, gives us every reason for faith in the Wongan Hills Light Lands Farm. Approval has been given for fencing the block on similar lines to those carried out at the Merredin State Farm, which has been found by experience both dog and rabbit proof. The present Government has manifested its bona fides in the

scheme, and it is more than probable that the Minister for Agriculture (Hon. M. F. Troy), whose picture we show setting in motion the machinery destined to prove this venture, is marking an epoch in the agricultural history of the

Interested Spectators.

State. The acquisition of such definite information as the Wongan Hills Light Lands Farm has been devised to procure is a necessity it would be foolish to ignore. It is gratifying to know that its application will be no longer delayed, and every step taken in the direction to which we are now committed will be watched by the many with eager expectancy.

"THE JOURNAL OF AGRICULTURE"

will be supplied free *on application* to any person in the State who is following Agricultural, Horticultural, or Viticultural pursuits, to Agricultural Societies or Associations, and to any person otherwise interested in Agriculture.

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TUBERCULOSIS IN DAIRY CATTLE.

F. Murray-Jones, B.V.Sc., M.R.C.V.S.,
Chief Inspector of Stock.

Tuberculosis is a disease of the greatest importance, not only from the fact of the economic losses to cattle owners, but also owing to its prevalence in the bovine species and the consequent serious bearing on the health of mankind through consumption of milk and meat. The world's authorities of to-day are agreed that the consumption of milk from tubercular cows is a grave

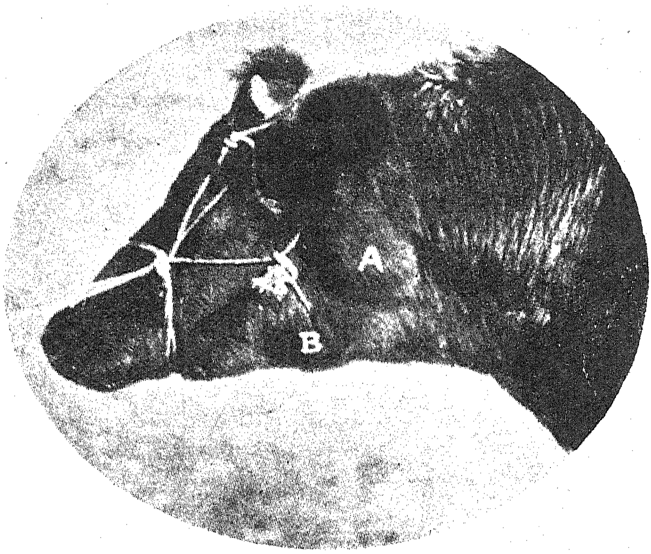


Fig. I.—A Typical "Lumpy" Animal.
A Tubercular subparotid lymph gland. B Tubercular submaxillary lymph gland.

menace to the health of mankind, particularly so in the cases of the very young and the aged.

The population of Perth and its adjacent suburbs are protected from one phase of this danger (*i.e.*, consumption of tubercular meat) by an efficient system of meat supervision. However, another aspect is the health of the animal responsible for the production of our milk supplies. This remark is not intended as an alarm note, but is made simply to direct the attention of dairy cattle owners to the need for greater vigilance, care, and attention in respect to any indication of tubercular trouble in individuals of their herds, and to suggest measures of co-operation with the officials at present responsible for their supervision, toward one end, namely the eradication of the disease. The Stock Department is seizing this opportunity of placing before those interested the real significance of this form of the malady, and at

the same time directing the attention of stock owners, by practical suggestions, to the best means of safeguarding their own, and at the same time others' interests in the detection and elimination of this disease in their herds.

The dairy cows of Western Australia may be divided geographically into metropolitan and country residents, but the percentage of tubercular animals in the one area must not be quoted as the index of the other: *e.g.*, because one hears occasionally of several animals in a metropolitan herd being tubercular, it certainly must not be taken to convey that this represents the

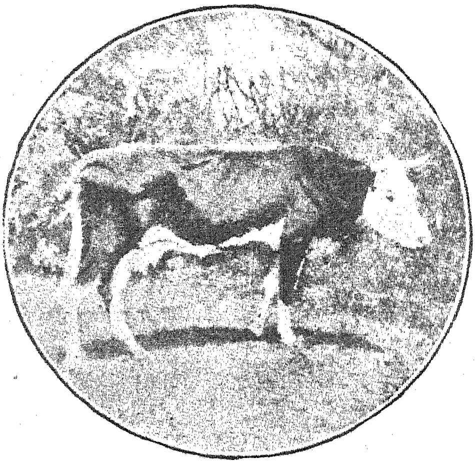


Fig. II.—A Typical "Waster" or "Piner."

state of every metropolitan herd, or can it in any way be made to represent the state of herds existing in the country. Experience and authority agree on this point; that the closer animals are herded together, especially under doubtful hygienic conditions, and the closer they live to mankind, the higher will be the percentage of disease. On the other hand, the wider animals graze, and the less frequent their contact with mankind, the smaller the number affected. The doctrine of tubercular emancipation is being preached by the authorities of the leading countries of the world. Even England, conservative as she has been in the past, has now fallen into line and has passed an Act known as the Tuberculosis Order. American cattle men are beginning to appreciate these forward movements, and have refused to admit any animals that have failed to pass the tuberculin test.

Cause of Tuberculosis.

The causative agent of this disease, the bacillus tuberculosis, was discovered by Koch in 1882. It is a slim, straight rod, measuring 2.5mm. to 3.5mm. long, and .3mm. to .5mm. thick. It grows on blood serum in from 10 to 14 days, but will not grow in ordinary agar or gelatine. There are three varieties of bacillus tuberculosis, *i.e.*, human, bovine, and avian. The bovine is shorter and thicker than the human; it is more virulent for cattle than the human: *e.g.*, inoculation of this form into cattle produces generalised

tubercular, but inoculation of the human only produces a local form. An important point is that outside the animal body the organism, if exposed to direct rays of sunlight, are soon killed. The dried expectorate from the cow

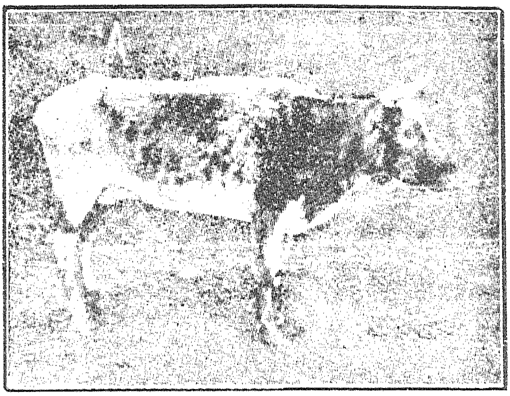


Fig. III.—A Suspicious Case.

containing the organism has been proved to remain virile for over 150 days. Sunlight, ventilation, and disinfection are the enemies of this organism.

Predisposing Causes.

Sufficient for the purpose of this article the predisposing causes may be summed up in two words—constitution and environment.

It is a recognised biological fact that the finer or higher the standard of the breed, the less resistant is the subject to an invasion of this character. Some breeds, like the Jersey, seem less resistant than others of a coarser type to the disease. The inference is not that Jerseys are in the ascendancy so far as percentage, but when subjected to condition of infection are less able to resist. As man has sought, by a system of selective breeding and domestication, to produce an animal on the lines of a milk machine, he has largely reduced that character of hardiness once possessed by the bovis under their natural condition.

Environment.—This plays a much larger part than that of so-called heredity. Cases of congenital infection are occasionally met with, but these are due to infection direct from the womb, or by portal blood stream. The retention of diseased animals in a herd has been found after a period of six to seven months to have infected their companions. Insanitary buildings, faulty drainage, filthy feed boxes, indifferent light, cowyards with several inches of dry manure upon which these animals recline, inhaling the dust and infecting the udder by way of the teats, are, in my opinion, the factors predisposing towards the disease.

Mode of Infection.

This occurs mainly by one of the three following channels: (1) Inhalation, (2) ingestion, (3) coition.

Inhalation.—In adult animals the most common mode of infection is by that of the lungs. This frequently occurs as the result of close contact with diseased animals. In old cows examined at the abattoirs and slaughter-houses

the lesions in the lung glands and lung tissue bear ample testimony to the path of infection. In this way one can easily understand how one diseased animal introduced to a herd can, in a comparatively short time, infect a number. Cattle do not expectorate in the way that human beings do, but

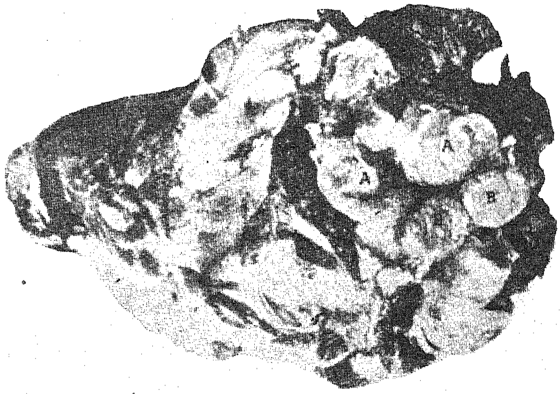


Fig. IV.—Tuberculosis in the Head.
AA Tubercular subparotid lymph glands.
BB Tubercular throat glands (retropharangeals).

as the result of the explosive effort induced in coughing a fine spray of moisture is discharged into the atmosphere in the form of small globules. These globules have been proved at times to contain the tubercle organism. These globules descend over herbage, fodder, fittings, as well as upon the companions of the diseased animal. Again, a percentage may dry, and in the form of fine dust be inhaled by other members of the herd. The chances of infection in this way can be easily understood when it is remembered how often we see three bails provided for 15 to 20 cows, and when it is the exception rather than the rule to observe any precaution being taken along the line of cleansing or disinfecting the bail and adjacent fittings.

Ingestion.—In old animals infection in this way is generally in the nature of a secondary infection. By this is meant that the animal has had the infection already in the lungs, and that during the progress of the expectorate from the lungs as it reaches the mouth it becomes swallowed, and so the organism is carried along the digestive tract with all the possibilities of infecting the stomach, bowels, etc.

In Victoria, prior to the introduction of the Dairy Supervision Act, it was found that a common cause of bowel infections in calves and pigs was feeding unsterilised separator milk that had been returned from the factory. This occurred in the following manner, *e.g.*: twenty farmers contributed milk to the factory. Unknowingly, one of them contributed milk from animals suffering from tuberculosis. At the factory the milk from the 20 was mixed. After the process of separating was completed the separator milk was run into a common receptacle, from which each man collected his share. What did this mean? It meant that infected milk left one farm but was distributed again to 19 others, and, being fed to calves and pigs, no doubt largely contributed to the percentage of the disease in these animals. A real menace to the health of the dairy cows of this State exists through allowing animals to feed from filthy boxes, often caked with dried discharges from earlier feeders whose health in this respect was perhaps of the most indifferent character.

Coition, or Sexual Contact.—Infection in adult animals may be spread by means of the bull during service. Occasionally one meets with a cow whose uterus on *post mortem* proves to be one mass of tubercular infection.

Fig. V.—Tuberculosis in Lungs.
AA Tubercular lymph glands (anterior mediastinals).

On inquiring the history of this animal, you learn perhaps from the owner that she could never be made to carry a calf, although a frequent visitor to the bull. You may also learn that she has been discharging, sometimes scantily, at other times freely. Bearing this in mind, it is an easy matter to imagine how a bull that has served such an animal could again in turn convey infection to other animals.

Congenital.—Cases have been noted of animals being born with evidences of the disease. This has been caused probably by the direct contact with an infected womb during the fœtal life.

SYMPTOMS.

The disease is usually insidious in its development, and slow and chronic in its course. They may be in the acute or early stages, or the chronic or advanced form. In the inital stages the presence of tuberculosis may be overlooked, and not uncommonly well-marked and advanced lesions may be found in slaughtered animals that appeared perfectly healthy in life. As the pulmonary or lung form of the disease is most commonly met with, the symptoms, as might be expected, are chiefly in connection with the respiratory system.

In popular language the following terms are used by cattle men to indicate certain classes of animals showing certain deviations from the normal: (1) The waster or piner; (2) the lumpy; (3) the cougher; (4) the roarer or snorer.

The Waster or Piner is an animal that may be suffering from the disease without showing any definite symptoms. It is usually unthrifty, remaining poor in spite of good feeding, tucked-up in appearance, arched in back, head carried forward, eyes sunken, face muscles shrunken, coat rough and staring, legs "proppy"; altogether a miserable and dejected animal. (See Fig. II.) Being moved quickly may give rise to a short, dry, intermittent cough, easily induced, especially early in the mornings if the weather be cold. This type of animal should be regarded with the greatest suspicion.

The Lumpy (see Fig. I.).—This term is meant to convey that the animal is suffering from a form of glandular tuberculosis, involving the "kernels" or lymph glands of the head or some other part of the body. The most common region is that of the head, frequently the parotid gland below the ear, or submaxillary below and on the inside of the angle of the jaw, or the retropharangeal gland situated at the base of the tongue. When the latter are enlarged they may be distinctly felt filling the space between the lower jaws. Often the term is used to indicate an enlargement on the jawbone itself, which is frequently of an actinomycotic character. Again, these lumps may be seen in other regions of the body in the position of the lymphatic glands, *e.g.*, (1) along lower part of neck, cervical glands; (2) at point of shoulder, prescapular glands; (3) in flank, precrural glands. One of the most important situations of this lumpy condition is the mammary gland, or udder.

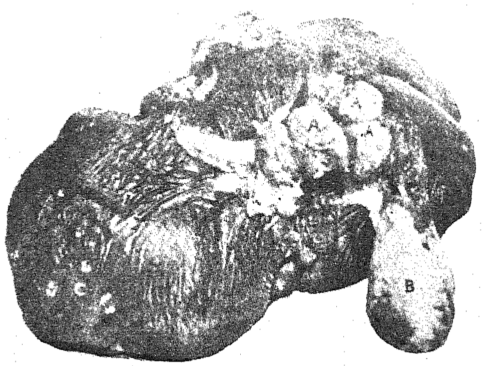


Fig. VI.—Tubercular Invasion of Liver.
AA Tubercular glands (hepatic-portals). B Gall bladder.
C Tubercle distributed throughout liver.

This gland is situated high up at the back of the organ, and the best method of detecting it is to examine the "bag" after milking. The person examining should stand at the side of the hind limb, one hand resting on the rump, and the free hand to be used in carefully manipulating the udder at the "back show" in the centre line high up. Should this gland appear enlarged and hard, somewhat resembling a walnut or golf ball, immediate steps should be taken to have the animal examined by a competent person. If neglected this may extend to other quarters of the organ, with serious effects on the milk, which may become infected with the tubercle organism. The term

"lump" is often used to describe the swelling caused by a grass seed abscess in the region of the throat. A rough guide is as follows: In the case of a grass seed abscess there is heat, pain, and a tendency to point or suppurate. After breaking, the skin at that spot is found considerably thickened. The more serious lumps are usually hard, "cold," and, in the case of tuberculosis, not inclined to suppurate. But in cases of actinomycosis there may be a suppurative discharge.

The Cougher.—By this term we refer to an animal whose cough is frequent, and may be short and dry or prolonged and moist in character. This is generally an advanced case, and there is usually a loss of condition. Nevertheless, we frequently meet with animals which, in spite of these symptoms, maintain condition, and yet on subsequent slaughter present extensive lesion. The appetite may be slightly impaired. Usually there is not any nasal discharge, and any expectorate is generally swallowed when it reaches the pharynx (gullet). The significance of this swallowing is that the expectorate generally contains the tubercle bacilli, and so secondary infection of bowels may take place. As this form of the disease progresses the animal becomes more emaciated, the eyes become sunken, followed by anæmia and general debility.

The Snorer or Roarer.—This symptom generally follows as the result of the glands at the base of the tongue (retropharangeals) becoming involved, and a distinct snoring sound is produced in moving the animal. When the larynx or voice box is affected by the formation of this tubercular tumor a distinct roaring sound follows.

The Owner's Responsibility.

It must be carefully borne in mind that it matters not where the lumpy conditions may exist, they must always be regarded with the gravest suspicion, and in compliance with regulations under the Stock Diseases Act are to be treated as notifiable diseases. *Immediate notification to the local stock inspector or to the Stock Department is necessary.*

The Tuberculin Test.

This test is used for the purposes of diagnosis. The principle of the method consists in the thermal or temperature reaction which follows the introduction of a quantity of specially prepared glycerine extract of pure cultivation of tubercle bacilli. The test requires skill and knowledge in its use. In the hands of the untrained or inexperienced the results are misleading and absolutely unreliable.

Preventive Measures.

Hygiene.—In discussing this aspect as bearing a most important part in the spread or eradication of this disease, one cannot emphasise too strongly the necessity for a higher standard of hygienic conditions than at present exists as regards buildings, drainage, disinfection, light, and ventilation of places used for accommodation of dairy animals.

Buildings.—Many of the present day cowsheds were constructed probably from 30 to 40 years ago, without any pretence whatsoever to hygienic principles. In many cases sheds accommodating from 20 to 25 cows possess roofs so low that a man of average height must stoop to enter; the stall

accommodation so inadequate that it is almost an impossibility for a person to walk in and release the bail pin in order to liberate the cow; the floors are ill-drained, and the fittings corroded with the dust of ages.

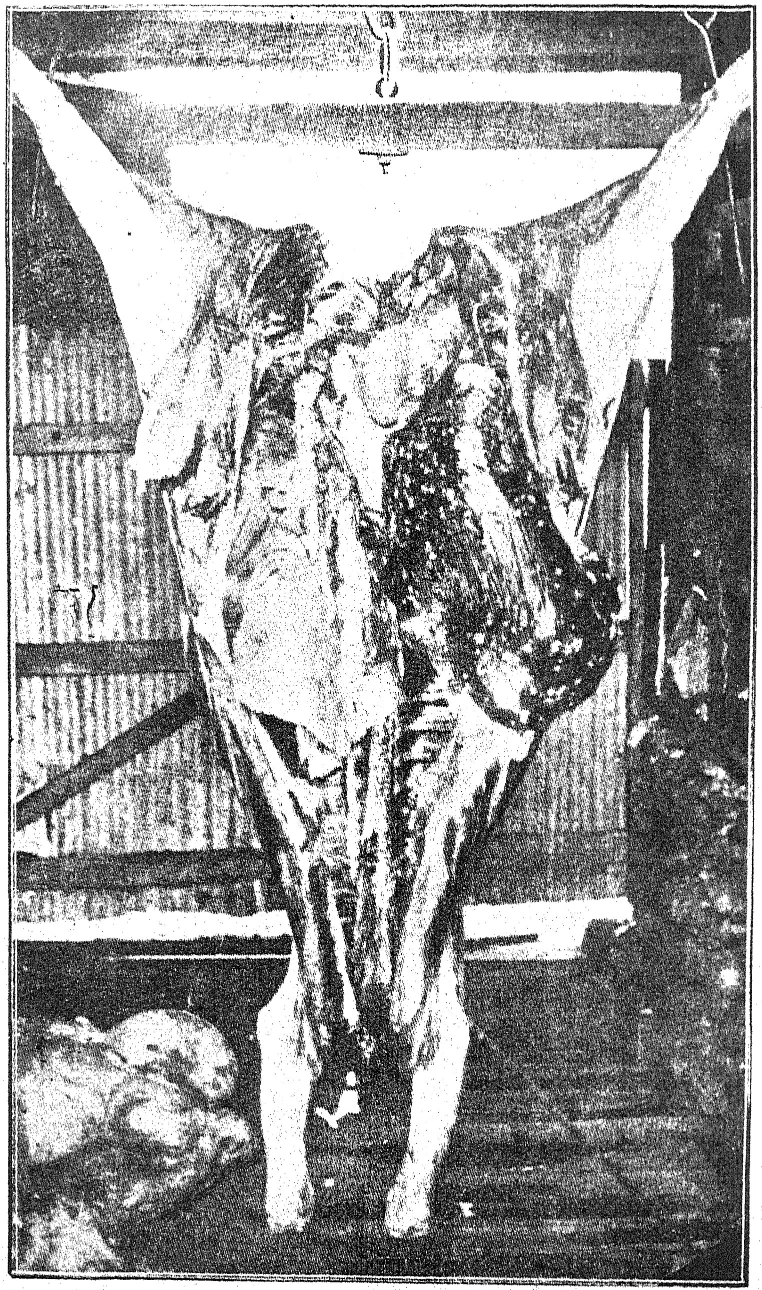


Fig. VII.—A Case Condemned for Generalised Tuberculosis.
Note: Lungs and Liver suspended to Carcase with Hooks.

Drainage and Disinfection.—These are phases that should receive the closest attention. In many obsolete sheds the floors are pervious, allowing absorption of the escaped body fluids. One effect of this is the pollution of the atmosphere breathed by the animals during detention, and another that accommodation is provided for disease organisms. A good, cheap, and effective disinfectant is the application of common lime, or the chloride of lime. The best way to use this is in the form of milk-lime, distributed with a spray pump. By this means it is an easy matter to disinfect floors, walls, and fittings.

Light.—All authorities agree that the influence of daylight has a beneficial effect on the health of the individual, whether that individual be human or animal. Sunlight has in a very short time a most destructive effect on the tubercle bacilli. There should not be any corner of a cowshed to which sunlight is unable to gain access.

Ventilation.—By this we do not mean draught, but simply the establishment of currents of pure air throughout a building by the provision of apertures provided at certain points; these being directed in such a manner as not to bear directly upon the animal within. A cowshed being open one way does not provide everything necessary. There must be a free circulation of pure air. How often does one find a cowshed cleanly in many ways but with a close and stuffy atmosphere, and the place black with flies, the latter often dropping into the milk cans waiting to receive the milk when drawn. On asking one owner why he did not have better ventilation, which would not only have sweetened the air but also dispersed the flies, he informed me "that it remained so for the comfort of the milkers during the winter." This man was evidently quite oblivious to the real object of good ventilation.

In urging that efforts should be directed along the lines indicated by providing conditions that will make for an improvement in the general health of the dairy cow, and so ensuring a higher degree of resistance to this dreaded disease, one cannot overlook the good work that has been done in Victoria in this direction. On the introduction of the Dairy Act in 1906, dairymen in Victoria were strongly opposed to what they called new-fangled ideas, but what do they say to-day? The men whose opinions are worth the having are more than satisfied with the results. The latest statistics quoted by the Director of Agriculture (Dr. Cameron) and the Chief Veterinarian of Victoria show that in the districts where the Dairy Act is in force the percentage of tubercular cases are considerably lower than before, this being largely due to the improved conditions under which the dairy animals are being kept.

FEED IN RELATION TO BUTTER-FAT TESTS.

"Many farmers have endeavoured, without or with little success, to raise the test by the use of certain kinds of feed," writes W. N. Paton in the *New Zealand Journal of Agriculture*. It can be safely stated that there is no feed which will of itself appreciably raise the test. By the use of certain feeds it is possible to raise the test by small amounts, but such increases are usually only temporary. Provided a cow is well fed, and receives a good variety of palatable food which supplies the essentials, she will return as much butter-fat by this means as by any other, and with less trouble to the feeder.

PHOSPHATIC FERTILISERS AS MANURES FOR GRASS LANDS.

A. B. ADAMS, Dipl.Agric.,
Agricultural Adviser, Dairy Branch.

The various commercial fertilisers contain their phosphoric acid in several forms of chemical combination, as follows:—

(1) Tri-calcic phosphate.
(2) Mono-calcic phosphate.
(3) Di-calcic phosphate.
(4) Tetra-calcic phosphate.

(1) Tri-calcic phosphate ($Ca_3P_2O_8$), which is always considered agriculturally as consisting of three parts of lime (CaO) and one part phosphoric acid (P_2O_5), can be represented diagrammatically as—

$$\left.\begin{array}{l}\text{Lime}\\ \text{Lime}\\ \text{Lime}\end{array}\right\}\text{Phosphoric acid.}$$

The term tri-calcic phosphate is not chemically strictly correct, as in addition to the three parts of lime and one of phosphoric acid there are generally small amounts of one or more elements present in combination.

This form of phosphate is found in bones and other animal remains, such as guano, which have not been treated with a strong acid. It is so very slightly soluble that it may be described as insoluble in water. In soil water, which contains carbon di-oxide in solution, and is therefore weakly acid, tri-calcic phosphate is slightly soluble. The extent of its solubility varies—

(a) With the material, bones being more soluble than the rock phosphates, and these again vary in their solubility, some of the softer ones being almost as readily available as bones, while others are very resistant to weak acids.

(b) With the fineness of grinding—the finer any material is ground, the more readily is it acted on by the solvent. Fine salt dissolves more readily than coarse, and this, again, quicker than rock-salt.

(2) Mono-calcic phosphate: this is not found naturally, and is prepared by treating tri-calcic phosphate with an acid, sulphuric acid being always used in practice, two parts of lime going into combination with the acid and two parts of water joining up with one part of lime and one of phosphoric acid when the acid and tri-calcic phosphate are mixed together in the correct proportions. The reaction may be represented diagrammatically thus:—

$$\left.\begin{array}{l}CaO\\ CaO\ P_2O_5\\ CaO\end{array}\right\}\quad\text{and}\quad\left\{\begin{array}{l}H_2O,\ SO_3\\ H_2O,\ SO_3\end{array}\right.$$

gives—

$$\left.\begin{array}{l}CaO\\ H_2O,\ P_2O_5\\ H_2O\end{array}\right\}\quad\text{and}\quad\left\{\begin{array}{l}CaO,\ SO_3\\ CaO,\ SO_3\end{array}\right.$$

or—

$$\left.\begin{array}{l}\text{Mono-calcic}\\ \quad\text{phosphate}\\ Ca\ H_4\ P_2\ O_8\end{array}\right\}\quad\text{and}\quad\left\{\begin{array}{l}\text{Calcium sulphate}\\ \text{(or Gypsum)}\\ 2Ca\ S\ O_4\end{array}\right.$$

That is to say, that when tri-calcium phosphate of lime and sulphuric acid are brought together in the correct proportions a chemical reaction takes place which results in the formation of a phosphate of lime which is soluble in water, and gypsum or sulphate of lime is also formed.

(3) Di-calcic phosphate: this compound is formed when phosphoric acid or mono-calcic phosphate is treated with lime or lime water. It is only slightly soluble in water, but is easily soluble in weak acid, and in water its solubility is greatly increased by the presence of many neutral salts, *e.g.*, ammonium citrate. It is more readily available as plant food than is tri-calcium phosphate. Di-calcium phosphate is found in basic superphosphate, most of the phosphoric acid in this manure being in this form. There is generally about one per cent. in superphosphate, when it is described as citrate soluble or reverted phosphate. It is also formed in the soil when the dissolved water-soluble phosphate, in superphosphate, comes in contact with carbonate of lime.

(4) Tetra-calcic phosphate ($Ca_4P_2O_9$), or a compound of four parts of lime with one part of phosphoric acid. It was at one time considered that this was the form in which phosphoric acid was found in basic slag; more recent opinion tends to the view that the bulk of the phosphoric acid in slag is present as a complex lime, iron, silica, phosphate; the true tetra-calcic phosphate being less soluble than slag phosphate.

Iron and aluminium phosphates are not important to the farmer as constituents of manures, as they are seldom found in commercial fertilisers. They are very insoluble in water, and are not dissolved to an appreciable extent in weak vegetable acids. They are of importance in manuring, however, as in soils deficient in lime or containing an excess of iron there is a danger that phosphoric acid applied to the soil may combine with the iron to form an iron phosphate, and thus, though not lost to the soil, will be present in such an insoluble condition that plants will be unable to make use of it. The more soluble the form of phosphoric acid when applied to the soil, the more quickly will it go into combination with substances present in the soil.

If lime is present, a di-calcic phosphate will be formed which will no longer be soluble in the usual sense, but will be available to plants; if lime is deficient or iron is in excess there is a danger that the iron phosphate will be formed. It is probable that the rapid formation of an iron phosphate accounts for many cases where a heavy application of phosphatic manure gives only a small return after the first season, although the first season's crop can have removed only a fraction of the P_2O_5 applied.

The following are the most important of the phosphatic fertilisers at present used in Western Australia, excluding compound manures made up for use on special crops:—

(1) Superphosphate: Large amounts of this are used annually in this State. Its use in the wheat belt has made possible the utilisation of land which, without it, would not pay for cultivation, and with it, give handsome returns. In the wetter areas it has been used for many years on the cultivated crops, but only to a limited extent, as a manure for grass land in the form of top-dressing. Its use for this purpose is now extending rapidly, and is likely to increase even more rapidly in the near future.

The whole of our supplies are manufactured in the State from phosphatic rock imported from Christmas and Nauru Islands, where there are millions of tons of this substance formed from the leached deposits of now extinct sea-birds.

The rock is pulverised by grinding and then treated with sulphuric acid, when the reaction occurs as explained on page 172. After a thorough mixing the mixture falls into the "den," where it dries, partly from the heat of the chemical action and partly from the anhydrous calcium sulphate taking

up two molecules of water to form gypsum. After drying the "super" is removed from the den by mechanical means, reground, and bagged ready for transport to the farm.

The sulphuric acid used is also made at the fertiliser works, and is prepared from Sicilian or American sulphur.

The superphosphate is sold with a guaranteed analysis, which is at present very high, viz. 22 per cent. total phosphoric acid, of which over 20 per cent. is water-soluble. Over half the weight of superphosphate is gypsum, which is not charged for, but which is of value on some soils, it having been found to give an increased crop in several cases when used as a manure.

In local experiments the increase was not sufficiently great to justify its purchase and use alone. It is, however, probable that its presence in super accounts for this manure giving better results than some other forms of phosphatic manure in areas of heavy rainfall, where it would be anticipated that a less soluble manure would give equally good results.

(2) Basic superhosphate: This is a mixture of 85 parts of super with 15 parts of air-slaked lime. After thoroughly mixing the mixture is allowed to stand 24 hours before sowing or re-bagging. By this treatment the phosphoric acid of the super is converted into di-calcium phosphate, which, although no longer soluble in water, is practically as available to the plant.

Basic phosphate should not be mixed with sulphate of ammonia.

(3) Double Acid Phosphate is seldom, if ever, quoted here, though occasionally inquiries are made concerning it. It is usually prepared from mineral phosphates of too low a grade to be used in the manufacture of ordinary superphosphate. The phosphate is treated with sufficient dilute sulphuric acid to combine with all the calcium, setting free the phosphoric acid; the muddy solution is allowed to settle, and the clear liquid, which is weak phosphoric acid, is concentrated and used to treat a further quantity of phosphate. The product is chiefly water-soluble phosphate. This manure is of economic importance only in places where freight and cartage are excessively high, circumstances in which the manuring of grass would not be profitable.

(4) Thomas' Phosphate or Basic Slag is a by-product of the steel industry: all the earlier slags on the market were from steel from the "Basic Bessemer" process invented by Thomas and Gilchrist (1878-79). By the introduction of lime into the molten metal the phosphorus, which, if retained, renders iron brittle in the cold, combines with the lime and is got rid of in the slag. The slag, if sufficiently rich in phosphoric acid, is first broken up into small pieces and then ground into a fine powder. Fineness of grinding is most important, and because of this 80 per cent. of "Basic Slag" should pass through a sieve containing 10,000 holes to the square inch.

The Bessemer process is now being largely superseded by the Siemens or open hearth process, which gives a slag usually with a smaller percentage of phosphoric acid than the Bessemer process. As the temperature of these open hearth furnaces is usually lower than the Bessemer converter, a certain amount of fluor spar (calcium fluoride) is added to make the slag flow more readily. The addition of the fluor spar has the effect of making the phosphoric acid of the slag less soluble in weak acids, and therefore presumably less soluble in the soil. This fluorspar slag is worth less to the farmer than the older type of slag, and though probably of value on grass lands when close to the source of supply, in any case superphosphate or the higher grade slags will prove more economical in use.

It is often stated that basic slag contains a large percentage of lime, various analyses giving percentages of lime (CaO) varying from 38 per cent. to 52 per cent. It must be remembered that only about 2 per cent. is present as free lime, the balance being present in combination with phosphoric acid and silica. The silica breaks down in the soil, and the lime which is set free is then of use. Three factors should be considered when purchasing basic slag:—

(1) Percentage of phosphoric acid. Usually the higher the percentage the better the slag.
(2) Fineness of grinding: this is very important, as unless finely ground the slag will have a very low availability.
(3) Solubility is not so important as (1) and (2), it having been found in experiments at Cockle Park that slags of medium solubility gave the best results.

Generally speaking, basic slag has not given as good results as superphosphate on the pastures of this State; therefore, unless the country has been proved for some particular soil, it will be best for the farmer to use super as a fertiliser for his grass land.

(5) Bonedust: Bones were the first phosphatic manure to be used on grass land. We first read of them as having been used in Yorkshire; then in the early years of the nineteenth century they were used in Cheshire to renovate exhausted dairy farms.

At first the bones were broken like road metal, in which condition their action was very slow, but extended over a long period. In 1829, Henderson of Dundee built a machine for making half-inch bones and bonedust. Bones contain about 20 per cent. phosphoric acid and 3.5 per cent. nitrogen. Some of the bonedusts on the market contain a higher percentage of nitrogen than this, as a large amount of organic matter is incorporated. Other samples, again, are very low in nitrogen, the bones from which they are prepared having been weathered for long periods.

Bonedust is so highly valued for horticultural purposes that it can but seldom be bought at a price low enough to make it a payable proposition on grass land.

(6) Dissolved Bones were first prepared by Liebig in 1840 by treating crushed bones with sulphuric acid, the tri-calcic phosphate of the bones being converted into a water-soluble phosphate in the same way that the tri-calcic phosphate of rock phosphate is converted into mono-calcic phosphate in the manufacture of superphosphate. In 1842, Lawes and Gilbert adapted this method to the treatment of mineral phosphates, and so founded the superphosphate industry.

In addition to the phosphoric acid, which is in the same state chemically as that in super, dissolved bones also contain some organic nitrogen. In practice it gives little if any better results than a mixture of super and sulphate of ammonia of the same analysis, and as this mixture can be obtained more cheaply it should be used when a manure containing some nitrogen is desired. In some cases, when first sowing down land to grass, a manure containing some nitrogen is desirable to give the young plant a good start. Even for clover, if the soil is not naturally rich in nitrogen, some nitrogen in the manure is desirable. Once the clover is established, further applications of nitrogen should not be necessary.

(7) Rock Phosphate: The mineral or rock phosphates vary greatly in their composition and solubility, varying with the circumstances under which they have been laid down and the age of the deposits. When finely ground

and applied in a heavy dressing (10 cwts. or more per acre) some of the softer phosphates have given good results on permanent grass in England. In small amount, by themselves, they are unlikely to be suitable to our conditions, though a mixture of ground rock phosphate and superphosphate may prove of value on ironstone or open sandy soils where a neutral manure is indicated.

(8) Bone Ash is not on the market, but is a useful way of using bones when no means of grinding them are available, or if the bones are suspected of being diseased. Bones burn readily, and after burning are easily broken up into a fine powder for distribution. No phosphoric acid is lost in the process of burning as it is not volatile, but unfortunately all the nitrogen is driven off; however, the bone ash is more valuable as a fertiliser than whole bones, and the loss of the nitrogen must be put up with, failing machinery to grind the bones. Bone ash contains about 37 per cent. phosphoric acid (P_2O_5), which is probably in a much more available form than the phosphoric acid in rock phosphate.

With the exception of ground rock phosphate, which is not suitable for general applications, of the above fertilisers superphosphate supplies phosphoric acid at the cheapest rate per unit. It has proved a suitable source over a very wide range of soils in the South-West, and it is therefore economic practice to use it unless there is experimental or other evidence indicating that it is not as suitable as other forms. In basic slag and basic superphosphate (not basic phosphate) the cost per unit of phosphoric acid is about the same, and the top-dressing experiments on the Abba River Groups indicate that similar results are obtained from either.

(To be continued.)

VALE J. S. OGILVIE.

Readers of the *Journal of the Department of Agriculture* will regret to learn of the decease of the late Editor, Mr. J. S. Ogilvie, who passed away in St. John of God's Hospital, Subiaco, after an illness of some four months' duration. Mr. Ogilvie was a man of broad sympathy and wide experience who had seen much of the world, besides being of a retiring disposition. He made many friends both inside and outside the Civil Service.

Born about 1862 in Arbroath, Scotland, he was educated at the Edinburgh University, and spent a considerable period of his life in travel before settling down in this State. For a time he occupied a position as school teacher in the North-West, subsequently accepting a position as Publicity Officer with the Forests Department, which work he carried on for a period of four years. When the Council of Industrial Development was formed Mr. Ogilvie was transferred to that Branch of the Service, again in the capacity of Publicity Officer, and latterly as Acting Secretary, which position he occupied at the time of his demise. Mr. Ogilvie contributed to several newspapers, including the *West Australian,* and for the past nine months was associated with this *Journal* as Editor. He leaves a widow, son and daughter to mourn their loss, to whom we extend sincere and heartfelt sympathy. His geniality and kindliness will long be missed by his large circle of friends.

THE LATE J. S. OGILVIE.

A REPORT ON FOUR YEARS EXPERIMENTAL CULTIVATION OF PEPPERMINT IN WESTERN AUSTRALIA.

H. V. MARR.

At the latter end of the year 1920, Plaimar, Limited, imported into Western Australia a quantity of Mitcham Peppermint Roots (*Mentha piperita officinalis*), Black Mint, with the object of testing the quality and quantity of the oil produced in order to ascertain whether the industry would justify development commercially. It has been stated at various times that when Peppermint is transplanted to districts outside its particular home in England, the chemical and physical properties of the essential oil undergo change; also that the most important property, that of the aroma, is subject to alteration. It is further stated that no Peppermint oil produced elsewhere in the world can equal the particular bouquet obtained from Peppermint oil grown in England.

The following brief report gives the result of several years' cultivation in Western Australia, and a comparison of the various analyses submitted, which have been taken over a fairly lengthy period, will indicate that the quality of the oil has shown comparatively little variation; in fact it may be said that from an analytical standpoint the constants of true Mitcham Peppermint oil have been well maintained.

It will be noted, however, that as experiments proceeded, an important constituent represented by the menthol content of the oils became higher than that generally found in Mitcham Peppermint oil, and considerably higher than that usually present in highest-grade American Peppermint oils.

The seasons in Australia are, of course, the reverse to those in England. The planting of the mint should take place in the early spring, and may be commenced at the latter end of July and proceed through to the beginning of October. The mint is ready for harvesting at the end of February, or the beginning of March.

The following are the results of the examination of various samples of Peppermint oil obtained, and in every instance the analyses have been conducted on the unrectified oil.

Year 1920-21.—The roots entered the State in December, 1920, and were planted immediately and allowed to grow until the following March, when the herbage was cut and a small quantity of oil obtained therefrom. This oil was of excellent aroma, but was of insufficient dimensions to conduct an analysis upon.

Year 1921-22.—The crop obtained this year was the product of the previous year's importation of roots, and sufficient oil was obtained to make an exhaustive analysis and test its quality. Small samples sent to London were pronounced to be of excellent quality. The herb from which the oil was obtained was cut and distilled in February, 1922, and had the following analysis:—

Specific gravity at 20° C.—0.907
Optical rotation— $-27°\ 42'$
Refractive index at 20° C.—1.461
Free menthol—52.9 per cent.
Combined menthol—6.4 per cent.
Total menthol—59.3 per cent.
The estimation of menthone in this oil was not carried out.

Year 1922-23.—In this year the roots were planted at Yarloop on reclaimed swamp ground; this district being about 80 miles from Perth. About one acre of mint was planted about the middle of September, 1922. The herb was cut and distilled at the beginning of March, 1923, and was found on analysis to have the following characteristics:—

Specific gravity at 20° C.—0.910
Optical rotation— −20° 42′
Refractive index at 20° C.—1.4570
Free menthol—58.7 per cent.
Combined menthol—6.7 per cent.
Total menthol—65.4 per cent.
Menthone—13.21 per cent.
Solubility in 70 per cent. alcohol—1 in 2.5 vols.

Samples of the oil distilled during this season were sent to London in the early part of 1923, and were favourably commented upon by experts, particular mention being made of the high menthol content of the samples.

Year 1923-24.—An area of about 25 acres in the same district as the previous years' experiments was put in, but owing to bad cultivation and continued recurrence of rain, causing floods, right through until the beginning of December, the planting was a failure. The results being so discouraging it was decided to omit distilling this season, as it was not considered the product would be a true guide. Late planting gave the mint a serious setback from which it was impossible for it to recover that season.

Year, 1924-25.—This year's experiments were carried out in the Byford district nearer to Perth, being situated about 28 miles distant, on soil varying from dark loamy to a rich chocolate, light in texture. Sufficient roots were brought from Yarloop to plant about 3½ acres of ground, and planting was commenced in the middle of September, and continued until the second week in November.

The mint made rapid headway in this locality, and seemed to thrive much better in the richer soil in which it was planted. The soil in the Yarloop area being swamp ground, was sour, and owing to repeated flooding in the winter time, planting could not be done until too late in the season to insure good results. At Byford, although ample water is available for irrigation purposes, a perfect system of drainage can be maintained, thereby removing any chance of the mint rotting due to the presence of too much moisture.

In the Byford district the only fertilisers used were a mixture of potassium and ammonium sulphates. A portion of the crop was cut and distilled in the middle of February, 1925. The resulting oil proved to be of fine aroma, equal to and probably better than that of previous years' experiments. This sample had the following analysis:—

Specific gravity at 20° C.—0.905
Optical rotation— −29° 11′
Refractive index at 20° C.—1.4635
Free menthol—62.24 per cent.
Combined menthol—6.1 per cent.
Total menthol—68.34 per cent.
Menthone—not estimated
Solubility in 70 per cent. alcohol—1 in 2.5 vols.

The balance of the crop was cut a fortnight later and distilled, same having commenced to blossom. Analysis of the oil obtained from the balance of the crop gave the following figures:—

Specific gravity at 20° C.—0.909
Optical rotation— - 25° 29′
Refractive index at 20° C.—1.4610
Free menthol—54.36 per cent.
Combined menthol—11.8 per cent.
Total menthol—66.16 per cent.
Menthone—9.46 per cent.
Solubility in 70 per cent. alcohol—1 in 2.8 vols.

Simultaneously with the planting of the crop at Byford in the year 1924-25, a quantity of the roots were also sent to the Mount Barker district, near Albany. The herb from this small plot was cut and distilled about three weeks later than the main crop obtained from the Byford experimental area. The Peppermint oil from the Mount Barker district gave a striking figure for total menthol, containing as it did 75.5 per cent., being over nine per cent. higher than any previous experiments conducted in West Australia by Plaimar, Limited. The oil was of fragrant aroma, but smelt somewhat more strongly of menthol than other samples produced. The following is the analysis—

Specific gravity at 20° C.—0.908
Optical rotation— - 31° 53′
Refractive index at 20° C.—1.4604
Free menthol—58.65 per cent.
Combined menthol—16.85 per cent.
Total menthol—75.5 per cent.
Menthone—not estimated.
Solubility in 70 per cent. alcohol—1 in 2.7 vols.

During the year 1925-26 Plaimar, Limited, expect to have planted 30 acres of Peppermint, and it is fully anticipated that the high quality of the oil obtained so consistently throughout the past years, will be well maintained.

Plairmar, Limited, are requesting the editor of the *Perfumery and Essential Oil Record* to publish the above details and to supplement the report with an expert opinion on the aroma and flavouring properties of the samples forwarded.

Some idea of the close proximity with which the locally-produced Peppermint oil corresponds with what is popularly termed "English Mitcham Peppermint Oil" may be gauged from the following limits of analysis within which English Mitcham Peppermint Oil is found to occur:—

Specific gravity at 15° C.—0.902 to 0.910
Optical rotation— - 20° to - 33°
Refractive index—1.460 to 1.463
Total menthol—58 per cent. to 65 per cent.
Menthyl acetate—6 per cent. to 14 per cent.
Menthone—8 per cent. to 14 per cent.

Quite independant of chemical analysis, however, is the important question of aroma, which property can only be decided by expert opinion, and in this connection the local oil has been favourably commented upon.

SHEEP ON THE WHEAT FARM AND THEIR MANAGEMENT IN WESTERN AUSTRALIA.

HUGH MCCALLUM,

Sheep and Wool Inspector.

The farmer is daily finding out the value of sheep on the wheat farm. The man on the land now realises that no farm is complete without sheep, under present day conditions. They are a necessity to enable him to obtain the highest possible return for his wheat or hay. The sheep enrich the land. They also keep same clean, as they will eat off all pastures prior to cultivation, which enables the crop not to be over-run with various grasses and weeds that come up with the crops should there be no sheep kept. Therefore, they take a definite part in the production of crops.

Where sheep are not pastured on the farm, grasses and weeds grow up with the crops, and absorb a certain amount of nourishment that otherwise would be available for the crops. From such unclean land the farmer cannot expect the returns to be as large as from clean land. Where sheep are kept stubble need not be destroyed, as the sheep can feed on it. This can also be stacked as a reserve of feed should there be a dry year. The grower who has a stock of stubble can always command a big price for same when feed is scarce. Reserves in feed of any kind, either in hay, stubble, straw, or chaff, are a necessity on a farm. Just as bankers or manufacturers must have reserves to conduct their businesses satisfactorily, so must the farmer have plenty of feed and water to see him through a dry season. It will not then be necessary for him to place his stock on perhaps a falling market.

Contrast the difference of the farmer who prepares for a dry summer to the man who, by not looking ahead, has had to place his stock on the market at a time when there is a glut. He has either to sell or see his stock die. The producers are conducting a business that requires every possible attention to make it successful; and to the man who conducts farming on business principles prosperity is assured. Should the crops be a failure from any unforeseen circumstances (wheat failures do occur) and sheep are not kept, there is no income. But if sheep are pastured there is a return from wool and mutton. It is certain that for many years wool and mutton will give large returns to the farmer. This writer's advice is—keep sheep where possible. The farmer should take a thorough interest in his flocks, small or large. In Western Australia, where land can be had on very favourable terms, there are opportunities for mixed farming which do not exist in other parts of Australia; and when wire and netting are available, and provision made for water by huge dams or wells on the holdings, prosperity will be assured, for you have two sources of income—wool and wheat. Farmers who for years only relied on wheat and could not by any persuasive means be induced to purchase sheep, thinking they could not look after them and grow wheat at the same time, have followed the example of those who have done well, after seeing their big returns. They have informed me that they regret not having had sheep years ago. These people are increasing their flocks, both in number and quality of wool, type and frame.

Practical experience is the sure road to success, and by keeping sheep the owner is daily learning more about them, and copying others who have made a success with sheep. Become acquainted with your sheep, and learn by comparison with standard works and leading journals published on stock. These articles are the result of practical experience, extending over many years, of men who have acquired it after years of hard work. All this is available to the beginner to start off with, at little cost.

The climatic conditions of Western Australia are such that the Merino sheep will do well anywhere except on the southern and south-west coast country, where Longwools do remarkably well and would give better results than the Merino. If possible, when the first flock is purchased, buy from those who are noted for having sheep of quality, being large-framed, growing a fleece of long combing wool, that are bred on country similar to your own. Few mistakes can be made if this advice is followed. There are many different classes of sheep, and the farmer should try to keep his flock to type. If it can be avoided, do not buy a mixed flock that consists of everything in the sheep line, and expect to build up a flock that will give you big returns in wool. This is impossible from such a flock. Keep sheep that give you the best returns per head. Why keep sheep that cut you only 4 or 5 lbs. of wool per head when you can have a return of twice that amount and even more from good sheep? As an illustration, a farmer runs 300 sheep giving a return of 4lbs. wool per head. This is only equal to 150 sheep giving a return of 8lbs. per head. Look at the loss of feed used by poor-woolled sheep, compared with a few good ones that will give an equal return. All over our farming areas you can grow wool of high value for which there is a ready sale, by careful selection and breeding a large-framed sheep. Western Australia has proved its adaptability for growing wool from the South to the North, and as our lands are sparsely stocked millions of acres of land are available for settlement in almost every part of the State. The same land in a few years' time will be able to carry many millions of sheep. The Merino sheep is of a hardy constitution; it will stand almost any hardship and will live on anything such as bush or low scrub in bad times, providing it has plenty of water. Its good qualities are too numerous to particularise, but as a wool and mutton producer it stands unrivalled. It is the most useful sheep for the farmer and requires little attention. Study the feeds grown on your pastures and learn to know if your stock are doing well. You cannot learn too much regarding their requirements, and the owner who takes interest in their welfare must gain knowledge.

Do not eat out your paddocks before changing the sheep to another paddock. This mistake is often the cause of sheep losing condition through neglect, and often it has been thought that the sheep are not suitable to the land. That is not the case. Yearly, the experience gained by having sheep helps you to be more proficient, and it is within the power of every farmer to have a good flock that will yield big returns from wool and mutton. The farmer who has kept sheep for years is always glad to help the new man along with any knowledge he may possess. Attend to the details which, although simple, are necessary to know where sheep are concerned.

Western Australia is free from sheep diseases, and can grow sheep of good constitution. This is everything where breeding is concerned. In many cases where sheep do not thrive, it is not the fault of the pastures, but the class of sheep. What do they consist of? Every possible kind. How are they bred? It is hard to state, for the reason that they were never cared for or culled; just allowed to breed anyhow, year in, year out. Were the undesirable units of the flock ever taken away? Was new blood introduced? If not, how is it possible for a flock to be kept pure? Such breeding has one result—sheep of a weak constitution. This class cannot stand any hardships. They are the first to die when dry times come. The object of the farmer should be to raise and retain that sheep which will pay best for the consumption of its food. Strength, activity, constitution, and suitability of the pastures are the first objects for a breeder. Culling is of the utmost importance to get your flock up to a standard regarding constitution. Make up your own mind

what sort of sheep will best suit your district and climate—Merino, Crossbreds, or Longwools—and what you wish to breed. Having done this, stick to same and do not be led away by one and another regarding your line of breeding if you have one type. Do not buy a strange ram to mate with your flock unless you are certain that you have got the sire you need for selection. It is by this means that the advantage is to be reaped. No good flock ever existed that was not of a type. A type cannot be fixed by any other method than selection. Having decided on your type, let *uniformity* be your watchword. Do not purchase rams this year from one breeder and next year from another who has a sheep varying from its predecessor in some essential quality. By this means you might retard, if not altogether prevent, improvement in your flock. Therefore have a distinct object and stick to it; the mixed flocks which one sees so frequently will then soon disappear.

THE VALUE OF SHEEP CLASSING.

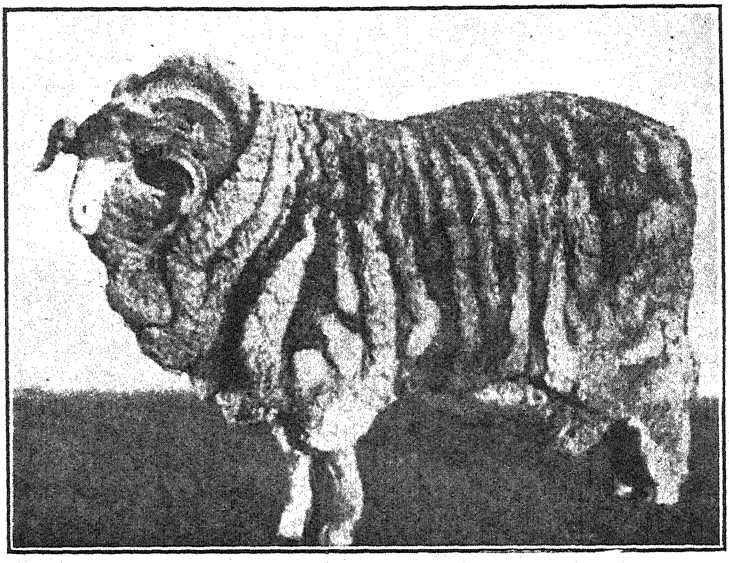
Sheep Classing.—This particular branch, which is most important, is often neglected or the classing is badly done by the sheep farmer. To be a thoroughly efficient classer, it is necessary for one to thoroughly understand and be able to recognise the various qualities and types of wool. The average sheep farmer can, however, with a little judgment, class his own sheep. It is every wool-grower's duty to class his sheep before shearing, and to cull his young sheep, so that in time to come he will possess a flock which is even, and as near perfection as possible. If the flocks are not culled, the undesirable units will retard its improvement. The sheep will soon deteriorate, and in time carry little wool. Some farmers contend it is unnecessary to cull the faulty sheep. What is profitable for the big sheep owner to do, applies also to the small one, whose aim should be to breed a flock, though small in numbers, yet of the highest quality. This particular work will more than repay him by the high return per head for wool, and by having a flock of large framed and strong constituted sheep.

The improvement that has taken place in the flocks of Western Australia of late years is the result of thorough and systematic sheep classing. Western Australia has to-day flocks equal to any in Australia, and the unrivalled position it holds for producing wool of high value has only been achieved by sheep classing. Our progress in sheep breeding has been recognised, when it is seen that Eastern States' breeders purchase our rams for their flocks. We have a country of great vastness, with a climate and rainfall more even than in any other part of Australia, suitable in every way for wool production and a large export trade in mutton when the freezers are completed. We are most favourably situated by being the nearest Australian port to the English and Continental markets.

The main object of classing is to reject any faulty sheep, or those of a type other than the sheep farmer wishes to breed. The best time to class the flock is before shearing; the sheep are then about full fleeced. Class your young sheep, the future breeders of your flock. The percentage of culls to be taken out will greatly depend upon the standard of excellence set in the flock. In some flocks the number of culls will be decided by the number of sheep the farmer can afford to dispose of. The usual percentage of culls which require taking out in an ordinary flock of young ewes is 25 per cent. to 30 per cent. As the flock improves the percentage lowers, and the standard of the culls improves. Sheep having any of the following defects should be culled out:—

Small, under-sized, weak constituted, badly shaped, slab side, weak backed, narrow-chested, tucked-up appearance, long-legged, and carcase not in proportion to legs, and hollow and humped-backed or deformed sheep, also those having kempy hairs.

The wool on sheep of this class runs very coarse at the breech, and is full of long straight hairs, and is of low value. Sheep that are covered with wrinkles over the body should also be discarded. All sheep that are short-woolled, *i.e.*, with wool less than $1\frac{1}{2}$in. in length at 12 months old, and those with loose open wool, lacking density, and which are not covered evenly, such as no wool



A Merino Ram growing black-tipped and heavy-conditioned wool—not suitable for the farmer.

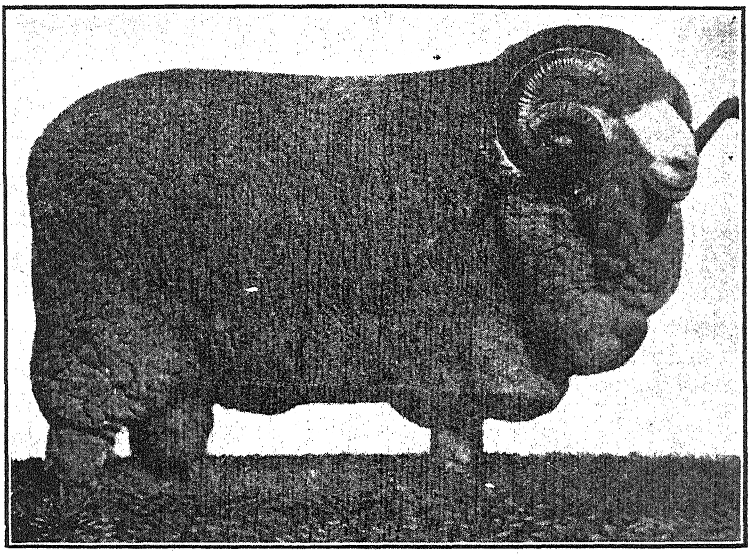
on the head, and clean legged or wool of a dull yellow colour carrying an excessive amount of yolk, would be best rejected at classing time, as well as those with cross-fibred wool, which is of low value.

After classing, the sheep should be run past to detect any with deformities which had been missed. Do not breed from the culls. The most profitable thing to do is to sell those not required as ration sheep. The flock will then be uniform. Every year the farmer will have some of his aged ewes to sell, the young sheep taking their places In classing these old sheep, sound judgment should be exercised. From past experiences the unprofitable sheep and those which have outlived their usefulness, and do not compare with the best ewes of the flock, will be known. It pays to class, and keep on classing, and this has been proved. Aim for perfection and one type. By doing so, the return per head will be increased, and this will more than repay for the extra work amongst the flock.

With large flocks, and when a man has experience, it is best to have a pen or race about five or six feet wide filled with sheep, and the classer can work through each lot, raddling the culls, and as he does each race they can be run out and drafted up the ordinary race while he is working on the next race, and so on. The culls should, after drafting, be cull-marked, as prescribed by the Brands Act, with a slit at the tip of the ear or alternately a punch hole in the centre of the ear.

THE SELECTION OF GOOD RAMS.

A good flock of ewes is useless without high class rams to mate with them. The rams should always be better than the ewes, and should be particularly strong where the bulk of the flock is lacking in order to counteract the deficiency. Breed for wool and frame, and endeavour to produce a strong, well-built sheep. A typical well-built Merino ram should be of a bold, muscular type. Why not allow his character in the wool? The ram should be thick in the neck, and the carcase round and free from wrinkles. The back should be even and straight, and not too long. The legs should be on the short side, with wool down to the hoofs. He should have plenty of width across the

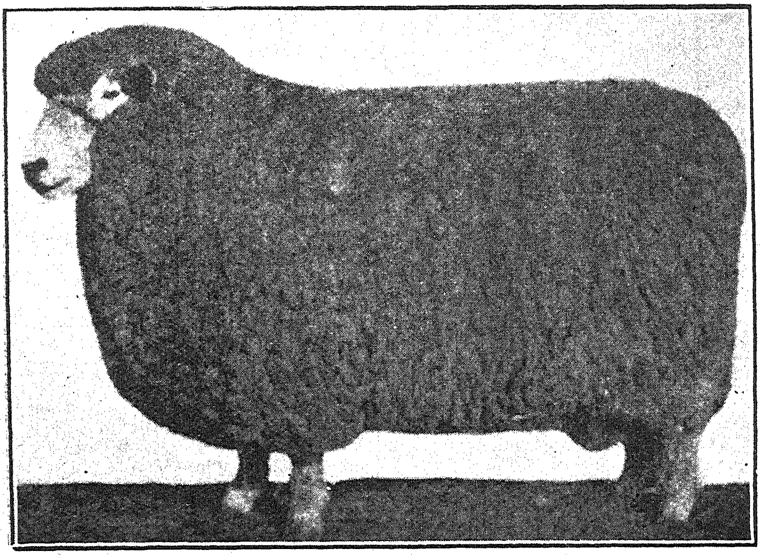


A well-bred Merino Ram.

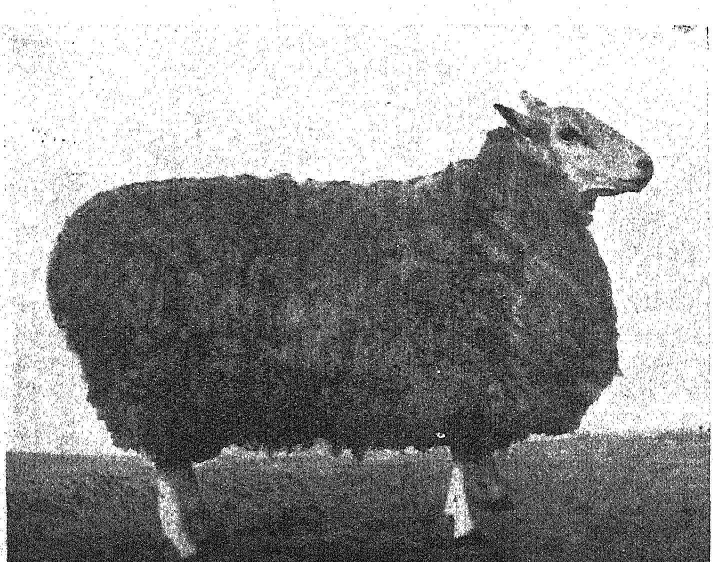
shoulders and loins, and the head should be in proportion to the body and covered with wool. The horns should not be too close to the head, the first curve being not less than an inch from the cheek. The face should be straight, with a good width between the eyes. The wool around the eyes should be clipped occasionally, so that it will not interfere with the sheep's sight. One of the most important things is the wool grown by the ram. It should have a long, sound staple, containing plenty of clean healthy yolk. It should not be dingy or discoloured. The ends of the staple should be free from black, hard tips. The staple should be straight and packed densely together. The wool should be fairly even in length and quality all over the body. The shoulder wool should be examined first, and taken as a standard. The wool on the remaining portions of the body should be as like it as possible in every way. The ram with wool that falls off much in length and density about the extremities and belly should always be rejected.

Select a ram with a full, bold, even front. He should move with a free healthy muscular carriage, and, if possible, these rams should be purchased from some reputable breeder. The best thing is to purchase good rams; the standard of your flock depends so much on the ram. Keep to the type established, and you cannot go wrong. There is no need for the farmer who com-

bines wheat growing with sheep raising to purchase his rams or ewes from the Eastern States; these sheep can be purchased at our local stud farms, situated in the vicinity of Katanning and Wagin, on the Great Southern line,



A well-bred Romney Marsh.

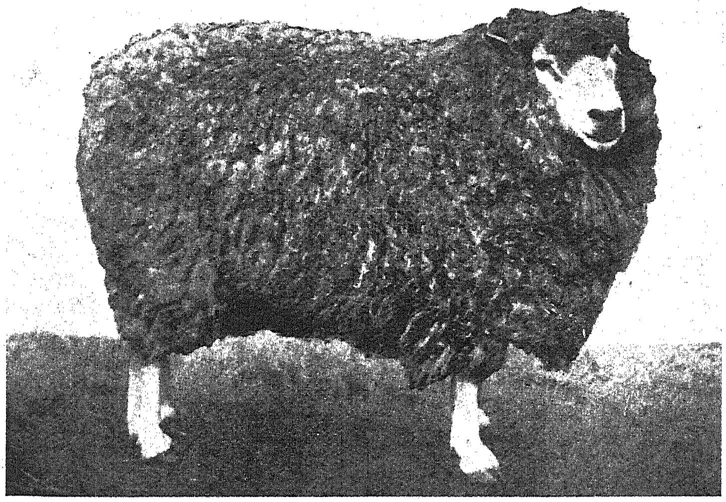


Border Leicester.

and also round Moora and Geraldton, on the Midland line. The sheep from these studs compare favourably with the leading studs of the East. By purchasing locally, you can inspect the sheep you wish to buy, and also help the stud owners who have put thousands of pounds into high class stock.

ENGLISH BREEDS OF SHEEP.

In many parts of our State English breeds and cross-breeds are a success, some farmers keeping nothing but pure English breeds. The Border Leicester, Leicester, Lincoln, Romney Marsh, Shropshire, and other English

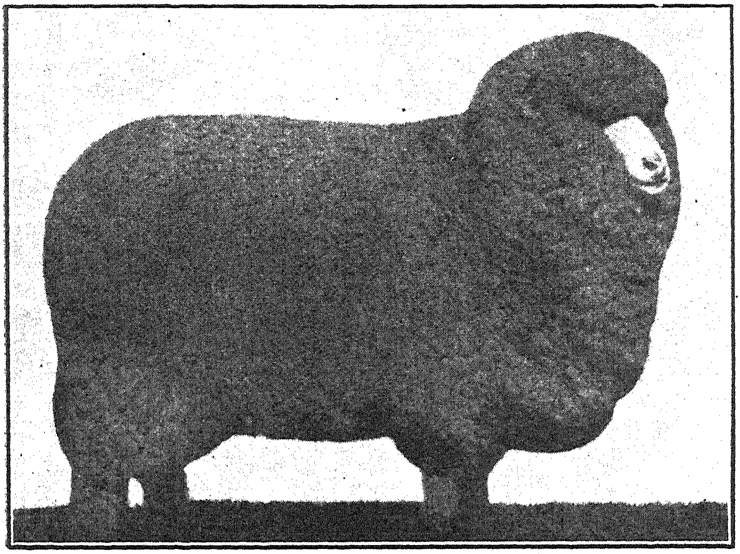


English Leicester.

Lincoln.

breeds have proved their adaptability in many parts of Western Australia. All these sheep have given good results when mated to the Merino ewe to produce early lambs. All English breeds and their crosses are suited to live

under farm conditions, but they must have an abundance of feed to maintain them in good condition. In selecting rams of the English breeds get a good typical ram of the breed you wish to keep, *always of pure blood* and sound constitution. Do not buy all the English breeds for your flock. If you do the result will be mongrel sheep of little value for either wool or mutton. When sheep are crossed in breeding it is hard to keep to type as they throw in all directions, though mostly resembling the sire.



A well-bred Merino Ewe.

In starting to breed a line of cross-bred sheep I would first procure a line of large framed Merino ewes and mate with the rams you have selected. The progeny of these would be half-bred. You will always get a proportion of sheep that are not suited, and it is impossible to get an even type from two distinct breeds. You must obtain the type you desire by culling. Mate the rams not later than the first week in December, and let them remain with the ewes not less than six weeks. The time should not exceed two months; a longer mating period would result in an unduly protracted lambing.

BREEDING FROM EWE LAMBS.

One of the greatest mistakes in sheep-breeding is the unfortunate practice of breeding from ewe lambs. The lamb makes its best growth in the first 12 months of its life, and if it is bred from under one year its growth is greatly retarded, and dwarfing must necessarily result.

In cases that have come under my personal knowledge, this practice has been the cause of the destruction of the flock; the size of the individual is checked, and the constitution weakened. Weight of fleece is reduced, and the percentage of lambs raised from ewe lambs generally is very low when compared with older ewes.

I would strongly recommend that this practice be discarded by all breeders, as, after all, constitution is the main thing in sheep.

LAMBING.

The percentage of lambs raised largely depends upon the care given by the sheep farmer to his flock during lambing period. The points to be remembered by him are—constant daily attention to the ewes; looking after new-born lambs insufficiently strong to help themselves, by giving them their first drink, etc., and providing shelter and shade in the lambing paddocks. Undulating country is the best for the latter, so that the ewes and lambs may escape exposure to the cold winter winds. The increased percentage of lambs and value of the sheep will repay the trouble.

WEANING THE LAMBS.

Allow the lambs as long as possible after marking before taking them from their mothers. Wean the lambs from middle October to November, according to circumstances. Always have the necessary paddock to receive the weaners, spelling for some time previously. They want the paddock with the softest and greatest variety of feed, with plenty of shade and water. It is most essential to see that these young sheep keep developing, as they never rightly recover if once they get a set back as lambs. Grass seeds are the lamb's worst enemies. There is no doubt that the shorn lamb does better in every way than the one left unshorn for the first year. The woolly lamb generally gets full of seed or burr, besides being more prone to the fly, and will not grow so well with the wool on, or do as well as when shorn. If the lambs are weaned at the shed when the ewes come up for shearing, the one drafting and mustering will do. Here each lot of ewes and lambs can be shorn as they are mustered. They can be drafted before entering the shed and a run of ewes and a run of lambs shorn, if the flock be large. The extra wool to be got by leaving the shearing of the lambs another month or two would not pay for all the trouble and expense of mustering, shearing, etc., unless it was a big shearing. When the lambs are shorn again at the following shearing, they have a fleece of hogget's wool with a level tip, denser and brighter and of more value than if they had been left unshorn, when the fleece would have a wasty tip, rather discoloured, and of much less value than the former. The separation of the sexes of the weaners can be carried out as they come up for shearing as hoggets. The ewes after shearing then become maiden ewes and are kept separate if the flock is large, after which they go to the rams, being then eighteen months to two years old. The wethers are either sold or kept for one, two, or three years before being sold.

CROSS-BRED AND ENGLISH BREEDS OF LAMBS.

These breeds require different treatment. When weaning these it is necessary to have good fences. If these lambs are to be held, they are better shorn. This class of sheep requires small pastures and plenty of succulent fattening feed, water and shade. These sheep being principally bred for carcase, the production of same as quickly as possible is the object aimed at. Where a few sheep are now pastured the carrying capacity in time will increase considerably by the growing of various feeds on the land. Added to the usual grasses, bush, etc., the fodder crop would enable the farmer to have sufficient feed during any time of the year. Work the holding to the best advantage for wheat and sheep, and the returns will more than pay for the extra work. Every farmer should have a small sheep yard, same being necessary for the easy handling of the sheep. (Plan herein shows a suitable yard.) The yard can be made at little cost from posts and rails, and once erected will last for all time. Same can be enlarged as the flock increases.

TICK AND LICE ON SHEEP—NECESSITY OF DIPPING.

Every farmer should look forward to the dipping of his flock. This is a matter of vital importance to the sheep industry of the State. Every owner of sheep must recognise in these times, when wool and mutton are so valuable, and the enemies in the form of destructive parasites are plentiful, that if allowed to remain such parasites are the cause of much loss to the owner financially, and to the State also. In our settled districts owners of sheep should be constantly on the alert to see that they are kept clean. This can be done by frequent examinations for tick and lice. When tick and lice became a pest in other parts of Australia the cost of eradication was considerable, apart from the losses to owners in wool cast from the sheep in paddocks, and the low value for tick-infested wool on the market. Should these pests prevail, could we estimate the decrease in wool and mutton values if allowed to go unchecked?

Regular dipping with proved poisonous powder dips is essential, and the instructions issued regarding them must be strictly carried out. Every sheep put through the dip requires to be soaked for not less than a minute. When sheep become lice-infested they will rub themselves along a fence or against a tree until the wool is torn from the backs or sides. They bite themselves to allay the irritation caused by lice, and in doing so pluck the wool from their bodies, raw sides being noticeable in places.

The farmer should dip his sheep from four to six weeks after shearing, and not a day longer. The value of dipping is considerable. Wool free from tick naturally brings higher prices than when infested with it.

Increased values are often lost through sheer neglect. In districts where farmers cannot afford a separate dip on each holding, the matter of installing one on the co-operative system should meet with general support. This can be erected at little cost to the interested parties. Every farmer must dip his sheep to keep them clean. This is compulsory, and most beneficial to the flock. The parasites mentioned will live anywhere, and will breed continuously on undipped sheep. Both tick and lice are frequently found on the same sheep. They live by sucking the blood from the unfortunate hosts. Sheep should not be dipped during extremes of heat or cold, when thirsty, or in a heated state from driving. When ewes and sucking lambs have been dipped, the lambs should be kept apart for a time.

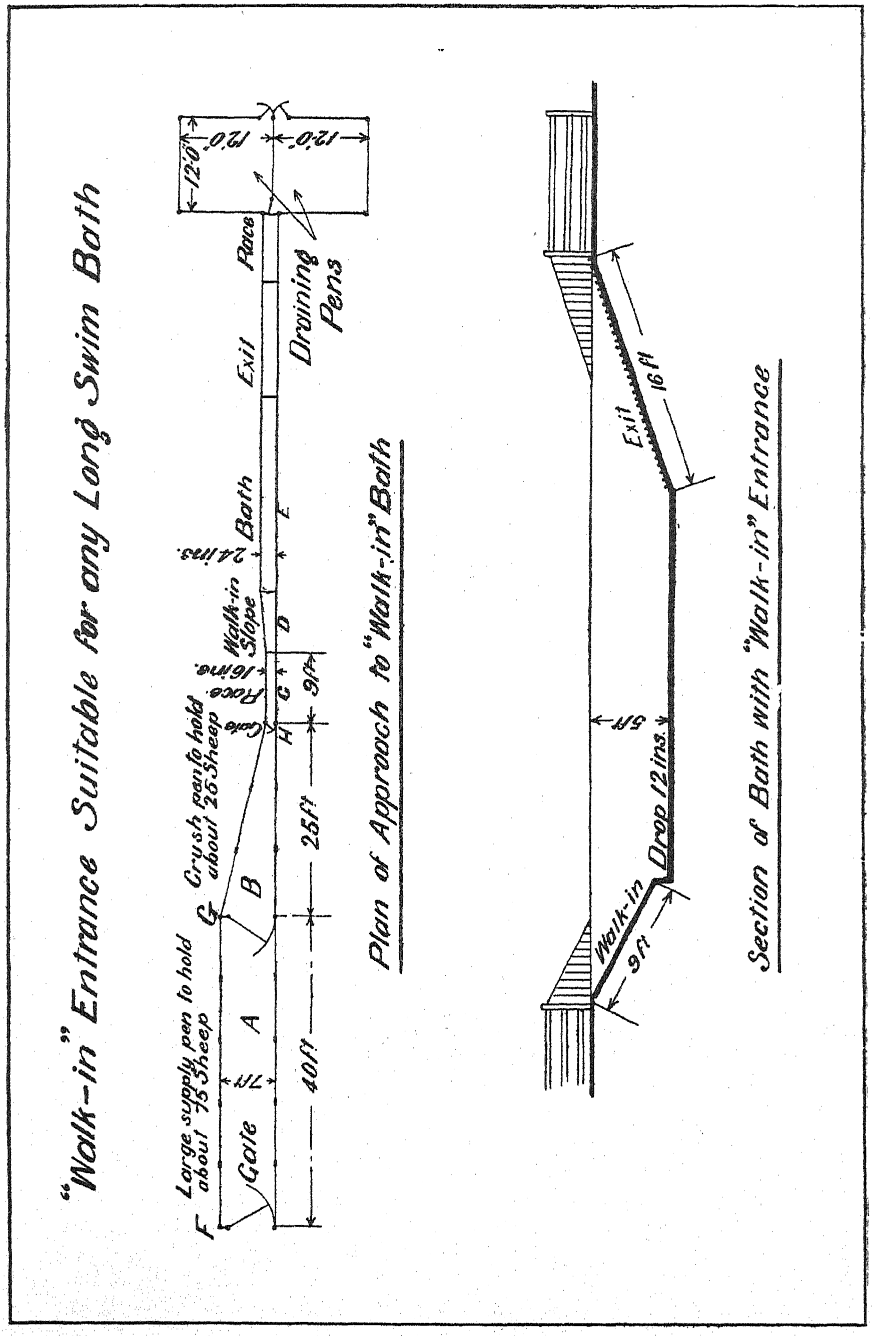
SHEEP-DIP—"WALK IN" ENTRANCE (see Plan).

A and *B* are supply and crush pens, which are fed from the usual sheep yards, with which the former should be connected. The latter should have a battened floor, the battens being made in sections, so that they can be removed after dipping.

C, race, 9 feet in length, 16 inches wide, sufficient to hold four sheep. This race should have a battened floor, to be removed after dipping.

D represents the "walk-in" section, and is an incline 9 or 10 feet in length (10 feet is better), gradient one in two, ending in a drop of 12 inches above the bottom of the bath. Its width at the point at which it connects with the race is the same as that of the race itself, namely, 16 inches; hence it gradually widens to 24 inches, to connect with the bath at the other end, of which it practically forms a part. The sides of the "walk-in" section are also, in all respects, identical with those of the bath.

E, portion of the swim bath.


"Walk-in" Entrance Suitable for any Long Swim Bath
F
Gate
Large supply pen to hold about 75 Sheep
7ft
A
40ft
G
B
Crush pen to hold about 25 Sheep
25ft
Gate
H
Race
C
16ins.
9ft
Walk-in Slope
D
24ins.
Bath
E
Exit
Race
12'0"
12'0"
Draining Pens
Plan of Approach to "Walk-in" Bath
Walk-in
9ft
Drop 12ins.
5ft
Exit
16ft
Section of Bath with "Walk-in" Entrance

F, G, H, represent gates; *F* and *G* are 4 to $4\frac{1}{2}$ feet gates hung on posts 3 feet or $2\frac{1}{2}$ feet from the side fence, so that when open they will close up the angles and form a "lead in." *H* is a small gate to close the four sheep in the race.

Two draining pens, each 12 by 12, are necessary, and a shed could be erected over same if required.

The size of the above dip can be reduced to meet the requirements of the small stock owner. A dip from 15 feet to 25 feet long is large enough for a small flock.

THE NECESSITY OF SHELTER IN WINTER AND SHADE IN SUMMER FOR SHEEP.

Shelter and shade are things that should not be forgotten on the farm. I have often seen farms that are without timber, and the ewes in winter when lambing are exposed to wet and cold winds. There are considerable losses in lambs under such conditions. In summer the sheep will do better with timber for shade than resting in the open with the hot sun shining on them. Keep timber reserves of a few acres on your holdings, same being invaluable when sheep are pastured. If the timbers on our lands are destroyed, what of the future? Let us be wise in time and benefit by the mistake made years ago in other parts of Australia.

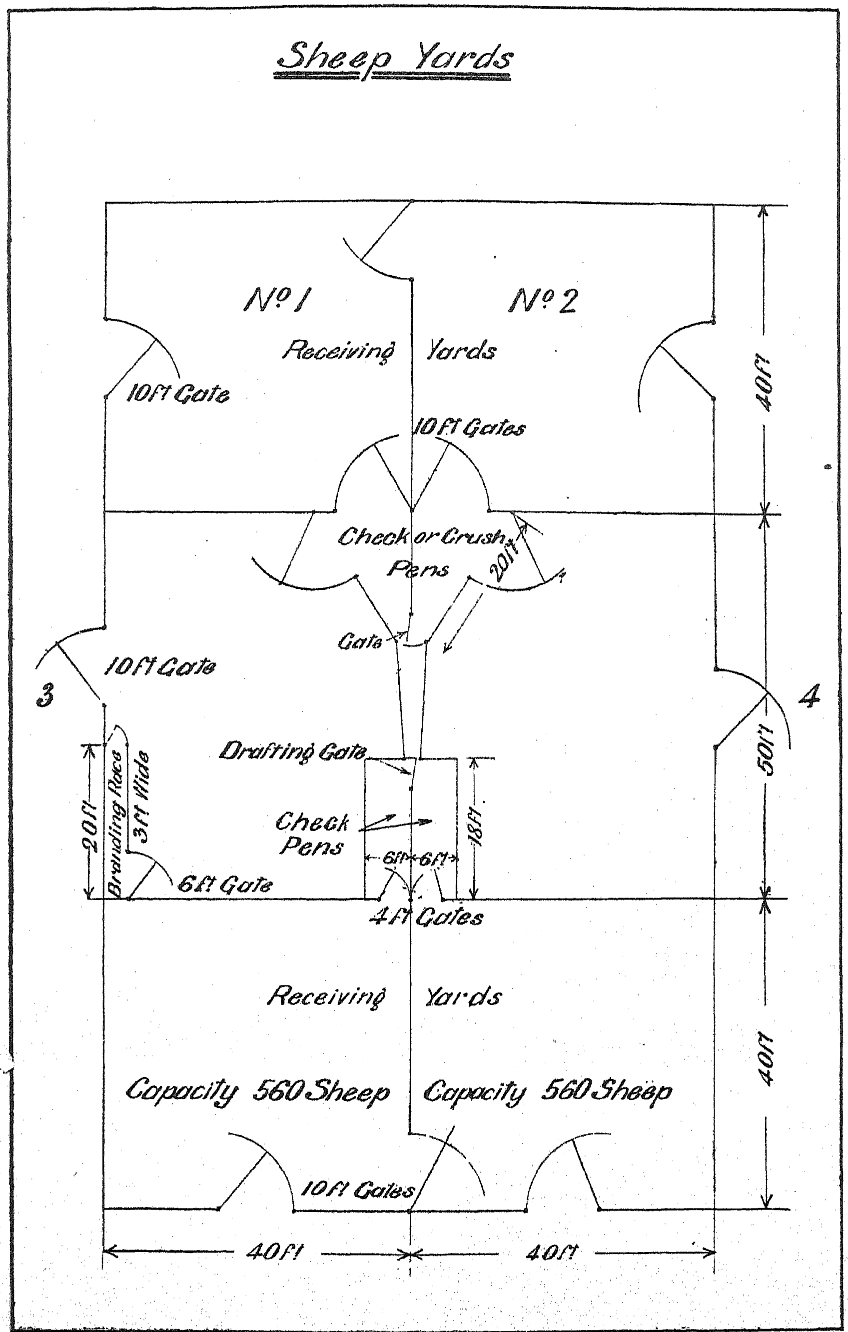
COMBATING THE BLOW-FLY.

The blow-fly pest has long since become a source of serious trouble to the sheep industry in Australia, and annually involves sheep breeders in heavy losses. In some years the mortality amongst sheep is much greater than in others, due largely to more favourable weather conditions for the breeding of the flies. Just before lambing time and during the wet season is the most dangerous period of the year. The sheep owner should watch the flock during this time for any sheep affected and attend to same at once.

A good method of prevention of the trouble is to crutch all your ewes by removing from the hind parts of the sheep all stained wool, etc. After being crutched the hind parts should be thoroughly well sprayed with a mixture of arsenical dip, and a quantity of castor oil in same will be found most effective in keeping the fly away. Experiments of jetting with an arsenical dip instead of crutching have proved most satisfactory in Western Australia.

CARE OF THE SHEEP SKIN.

After removing from the carcase, the skin should be hung out to dry—the skin takes from four to five hours to set—after which it should be painted so as to preserve the pelt against weevil. Paint the skins with weevil paint; care should be taken not to miss any part of the pelt. After painting the skins are ready to hang, so that both pelt and wool can become dry. The best and simplest method to adopt in drying is to hang the skins on rails. Place on the rails wool down and hang lengthwise from head to tail. After drying thoroughly the skins are ready for packing. It is necessary that they should be perfectly dry before being packed; if this is not so they are liable to taint and become damaged. Before packing cut off all trotters. The skins should be packed pelt to pelt, wool to wool, otherwise the pelt is easily damaged.


Sheep Yards
No 1
No 2
Receiving Yards
10ft Gate
10ft Gates
Check or Crush Pens
20ft
Gate
10ft Gate
3
4
40ft
50ft
Drafting Gate
Branding Race
3ft Wide
20ft
Check Pens
6ft
6ft
18ft
6ft Gate
4ft Gates
Receiving Yards
Capacity 560 Sheep
Capacity 560 Sheep
10ft Gates
40ft
40ft
40ft

SHEEP YARDS (see Plan).

There is nothing to prevent an increase in the number or the size of the receiving yards, so that the plan may be used by the owners of either a small or comparatively large flock. A man handling only a few hundred can put up a small yard on this principle, and the man who has to work from three to five thousand, by increasing the size can make it equally applicable. For that reason no actual measurements are given.

For a farmer with only a few sheep, No. 1 and 2 yards could be omitted, and receiving gates placed where marked 3 and 4.

WOOL SHED AND BARN (see Plan).

The illustration of a wool shed and barn shows a very convenient design for a small flock; let there be enough windows, as light is very necessary.

After each shearing this building can be used as a storage shed for grain, chaff, etc. The wool bins could be movable ones, and after use removed to a corner. Every part can be utilised.

For the future prosperity of the farmer in Western Australia a permanent number of sheep should be pastured on the farm year in and year out. Profits are made on the increase of those sheep and from the sale of the old ones. The farmer can then depend on a regular return from sheep, so much per head. This is better than dealing. A farmer must necessarily turn to mixed farming and grow crops of various feeds purposely for feeding the sheep. You have to feed every other animal on the farm, why omit the sheep? We have the land and it is necessary that we grow feed for the sheep that give such big returns.

FATTENING SHEEP FOR THE MARKET.

Many farmers in Western Australia do not pasture a permanent flock, but merely utilise the surplus growth of weeds and self-sown crops on their farms for fattening store sheep for the market. This naturally suggests itself to many land-owners.

For this purpose either ewes or wethers will serve; the latter will certainly realise the higher price in the market, but they cost more as stores and take, perhaps, longer than the ewes to put into prime condition. In buying wethers there is this advantage: they can be bought in the prime of life and in full vigour, whilst the ewes that are sold as stores—at a price that will pay for fattening—are frequently aged.

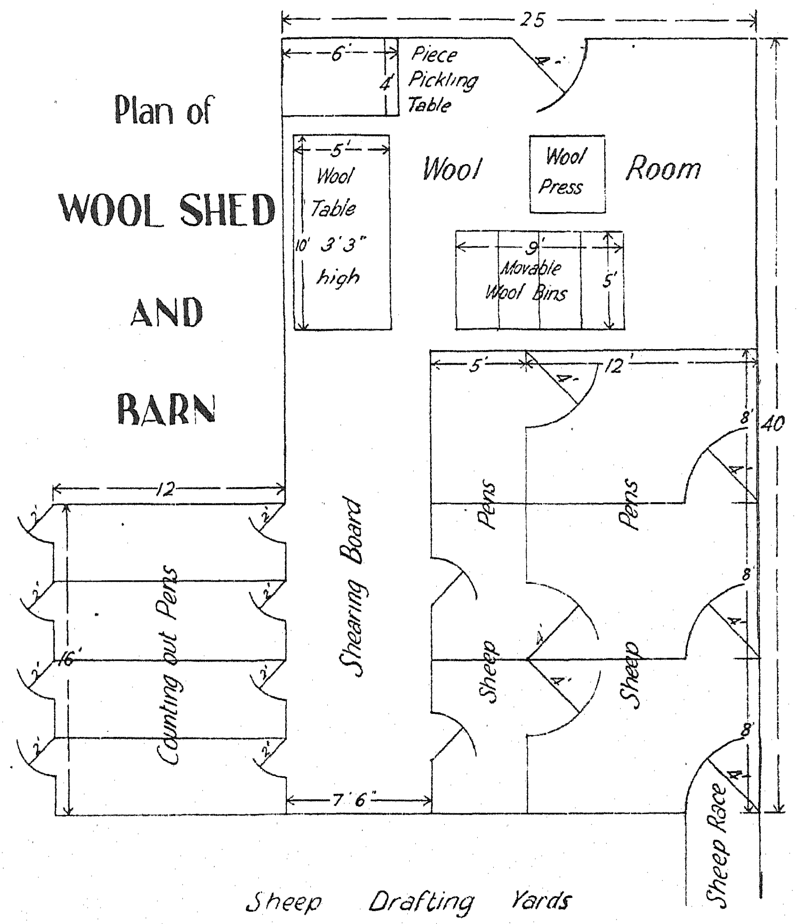
The grazier must be guided in the purchase of his stock by the local conditions and the ruling prices, which vary according to the season.

In making the selection care should be taken to see that all the animals are in the best possible health, of large well-shaped frames; undesirable animals never give satisfaction, and often sufficient food is wasted upon such sheep as would have fattened double the number of sheep with strong constitutions.

The farmer who purchase sheep to fatten often takes but little heed of the fleece, nevertheless, the wool has a considerable influence on the buyers at the sale yards. They know the difference between a good woolled sheep and a bad one.

In the wet parts of the State crossbred sheep will do much better than the Merinos and they, or the Long-wools, are well suited for fattening purposes in this country provided that they get plenty to eat without having to exert themselves too much to obtain same.

On our lighter and drier lands, with a less luxuriant growth of pasture, the Merino will often yield a better return than the cross-bred sheep, but in both cases much depends upon the choice of store sheep purchased, and this the grazier can only learn by experience.



When put in the paddock to fatten the sheep will be all the better if the owner goes quietly amongst them every day. This keeps them quiet and they settle down to feeding much more readily that when left entirely to themselves.

The sheep from the hot north will not do well on cold exposed country.

When buying sheep they should be, as nearly as possible, of the same age, even in size, and there should be no tail to the flock. To secure such a flock the farmer should be prepared to pay a higher price than for the ordinary run of stores.

The practice of fattening store sheep on the farms is becoming more general and wide-spread and now forms a very important adjunct to the pastoral industry, as will be seen by any person who attends the Midland markets each week. Many of these flocks may be described as mixed, but they leave the grazier a fair profit, and the quality of the farmers' flocks is steadily improving year by year.

YEARLY RECORD—WOOL ANALYSIS.

Number and Description of Sheep Shorn and Wool Produced.

Number of Sheep.	Description.	Number of Bales.	Total gross weight.			Weight of Packs.	Total net weight of Wool.			REMARKS. General condition of the Wool.
			cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	

Numbers.	Grown Sheep.	Number of Bales.	Total gross weight.			Bales per 1,000 Sheep.	Average weight of Bale.			Average weight of Wool per head.
			cwt.	qrs.	lbs.		cwt.	qrs.	lbs.	
	Lambs									

Total Clip ... ...
Wool sent to scour ... ...
Scoured wool ... ...
Total greasy and scoured ... ...

THE IMPROVEMENT OF DAIRY HERDS BY THE USE OF REGISTERED PURE "TESTED" BULLS OPERATING IN ZONES.*

P. G. HAMPSHIRE, H.C.D.,

Dairy Expert, Department of Agriculture, Western Australia.

The improvement of average cow production is of the greatest importance to the dairying industry throughout the world, and Australia in particular, in counteracting the set-back the industry has suffered since the war, due to increased costs of land, labour, foodstuffs, and materials required in dairy husbandry. The answer to increased production costs is increased unit production. The three principal factors in improving average cow production are: "Breeding," "Feeding" and "Weeding," and the main or basal foundation in the improvement of herds in type and production is breeding. Feeding, weeding or culling, handling and management are subsidiary. The foundation stone of the triumphal arch of successful dairying must always be breeding; all other additional stones in the edifice are of lesser importance, and the key to the arch which completes the structure may be likened to herd-testing, which becomes the key to successful breeding. Practically all instances of individual cow and herd increases and high production are the result of a steadfastness of purpose in breeding, namely, the concentration of one breed, using registered pure bulls whose dams and sires' dams are proved high producers. The value of the registered pure sire to improve common dairy stock, through their progeny, has been proved time and again, and admits of no argument. The registered pure dairy sire to "grade up" common stock represents the foundation of increased average cow production. Purity of blood is of great importance, in that it represents a dominance of pure, virile characteristics of one party to the mating which, because of their permanence, will displace the weak and less fixed characteristics of the other party to the union. The guarantee of purity is registration in an authentic Herd Book: purity without registration is as silver without the Hall Mark.

The influence of the registered pure dairy sire shown by an investigation into the records of Herd-Testing Associations in various parts of the world points definitely that herds headed by pure sires for a period of more than five years show greatly increased average milk production, and instances have been noted where the production has been as much as 1,500 lbs. milk and 85 lbs. fat per cow per lactation period higher than the production by herds headed by grade or mongrel bulls. Individual herd results have been noted which show production increase five years after procuring a pure bull, the members of the herd being the progeny of the original cows and equal to 120 per cent. increase in production.

Probably one of the most striking instances of the value of pure bulls in increased average milk production of cows is shown by the official figures published recently by the Department of Agriculture of America. The 48 States of the Union were divided into four groups of 12 States. The first 12 States, with an average of 51 per cent. pure sires, record an average production of 410 gallons of milk per cow per annum; the second 12 States, with an average of 31 per cent. pure sires, showed an average production of 330 gallons milk per cow per annum; the third 12 States, with an average of

* Paper read before the Australasian Association for the Advancement of Science (Agricultural Section), Adelaide, August 26, 1924.

19 per cent. pure sires, averaged 260 gallons of milk per cow per annum; and the last 12 States, with an average of only 12 per cent. pure sires, showed an average production of 200 gallons of milk per cow per annum. These figures, representing as they do the result of the production of nearly 25,000,000 dairy cows, are most eloquent in showing that increased production follows the use of pure sires.

Australia has approximately 3,000,000 dairy cows, an increase in average production of 10 lbs. butter fat per cow per annum, and at the average price of 1s. 6d. per pound paid for butter fat it is worth two and a quarter million pounds sterling. Australia has a big strength of co-operative organisation, and the industry is represented at dairy conferences by men of striking ability and organising capabilities, and a vast amount has been done in improving the manufacturing and marketing of dairy products. It is, however, felt that if this ability and organising experience were directed towards herd improvement a far bigger work could be accomplished in the advancement of the dairying industry.

The average annual production of cows in Australia according to the last figures published by the Commonwealth Statistician is as follows:—

	N.S.W.	Vic.	Qu'nsland.	S.A.	W.A.	Tas.
Milk, lbs. . .	3,300	3,300	2,330	2,940	2,010	2,980
Butter, lbs.	151	151	107	127	92	136

The next step in increased average cow production is the use of registered pure "tested" bulls. All pure bulls are not the progenitors of producing cows. Purity without production may be likened to a bucket devoid of milk. A dairy bull's value is his purity and the official production of his female ancestors. Purity and production is the combination. The higher the production of a bull's near female ancestors the greater his value as a dairy sire, and the greater the likelihood of his imparting to his progeny those productive proclivities. All bulls so bred do not improve their progeny, but averages of results are in the affirmative. The averages of herds have been increased from 130 lbs. fat in the case of the dams to 540 lbs. fat in the case of the daughters at each lactation. An instance is noted of the average production of all daughters of a bull being 250 lbs. fat higher than the average of their dams' production.

The results published in "The Dairy Farmer" of 1st June, 1924, under the heading of "Pure Bred Bulls and Production," show that in the State of Oregon, U.S.A., which has 49 per cent. pure "tested" sires, the average production of their cows has increased 17 per cent. during the last two years. The result of one Testing Association shows, where all pure bulls were used, that the average production of the cows ranged from 309 lbs. fat per cow per herd to 171 lbs. fat per cow per herd. All the highest herds under this association had been headed by pure bulls for a period of more than five years; the lowest herds were headed by pure bulls for a period up to five years, showing that their influence had not been felt. In seven herds, where pure-bred bulls had been used for 15 years, the average production per cow was 253 lbs. fat. In eight herds, where pure sires had been in use three years or less, the average production per cow was only 178 lbs. fat.

The next and most important step in increased average cow production is the use of registered pure "tested" bulls in *zones*. Zones, for their operation, become the natural corollary for the use of such bulls in "grading up." It obviously nullifies the good effects of the use of such sires if they are not used in a policy of continuity. The position as we find it in Australia par-

ticularly is that in the first place there is insufficient use of pure-bred bulls; secondly, there is comparatively a small number of farmers who use pure "tested" bulls; and, thirdly, the most serious of all, even when farmers are seized with the value of pure "tested" sires they change the breed with each mating. There are too few instances of a determined effort or a steadfastness of purpose in "grading up" by using such sires in a continuous policy with each mating. How often do we find a farmer hopelessly mixing the breed by the use of a bull of the different dairy breeds with each generation. The dairy farmer when starting cannot buy good type high producers, they are not available; but he can improve by breeding; and, even when he is seized with the value of the pure sire, it is fatal to breed on the lines that are often found, namely, starting off with, say, a Jersey bull; when this animal's heifers are old enough for breeding he looks around for another bull and is not particular about its breed, but because he has heard someone say that Ayrshires are hardier he buys an Ayrshire bull to mate with the graded Jersey heifers, and, when the resultant progeny of this cross are ready for breeding, a milking Shorthorn bull is procured with the idea perhaps, of getting more size or more saleable steers; and again, with the next generation, he may use a Friesian bull with the thought of increased milk flow, and after all these years of breeding he now expects an animal which has a combination of the advantages of all the breeds enumerated, viz., rich, high-testing milk; hardy, large frames, and heavy milkers. But what the farmer really has after his twelve or fifteen years of breeding is a mixed nondescript herd, all sizes, colours, types, and, worst of all, no improvement in production, but really a more definite mongrel than when he started, due to the conflict of type of each breed with each mating. On the other hand, with a defined system of breeding and the selection of a breed of sire to suit the climatic, pasturage, and marketing conditions for the produce, and a staunchness in keeping to that breed with each generation, a definite improvement is shown: the farmer has commenced a system of "grading up," and with each generation he infuses more pure blood and pushes out the low mongrel blood, attains type, an even colour, even size, and, what is of paramount importance, increased production. Further, when the pure sire used has female ancestry with high production capacity, the low producing herd at the start is built up to a high producing, highly graded and profitable herd, and the farmer has not only production but type also.

It is comparatively easy to improve future herd production through the progeny of low producing cows by the use of such bulls enumerated. It is more difficult, however, to improve on the production of high producing cows, and in making further advance bulls ex particularly high producing mothers must be used. Then there is the added zest to the man in herd improvement —pleasure and profit: pleasure in being able to point to his herd as something achieved—a herd of one type, even in size and colour—and profit, by increased returns from the cows. Improvement in constitution and size (if necessary), better shaped udders and placement of teats, are matters that may be rectified by the selection of sires whose "families" or "lines" are strong in the weaknesses of the cows to be mated, and, in the case of udder improvement being required, the dams of the bulls to be well developed in the particular weakness.

The need of a more defined system of herd improvement in Australia is apparent, and the zone system affords a solution of this most important subject. In Australia we have examples of the improvement of dairy cattle virtually by this system, such as the Milking Shorhorns on the South Coast of New South Wales, in parts of the North Coast of New South Wales, and

Queensland, the Ayrshires in certain districts of Victoria. Great improvement is noticed in the type and production of the stock in these districts really as a result of a system of "grading up," and the use of one breed of bull with each generation. Take the older dairying countries such as Denmark and Holland: there, one or two breeds of dairy cattle stand out, and no farmer would do other than use a bull of the particular breed he and his forebears have used with each generation of the herd. Again, in certain States of America one breed predominates, and invariably in the States that have the highest average production these two factors synchronise. The success of the majority of the dairy stud masters is, as a rule, due to a steadfastness of purpose in breeding, a concentration on one breed, and in all notable instances of high production, such as, for instance, the Milking Shorthorns of "Darbalara," the "Oakbank" Ayrshires, the "Wollongbar" Guernseys, and the "Glen Iris" and "Banyule" Jerseys, a high infusion of outstanding blood of the breed is maintained.

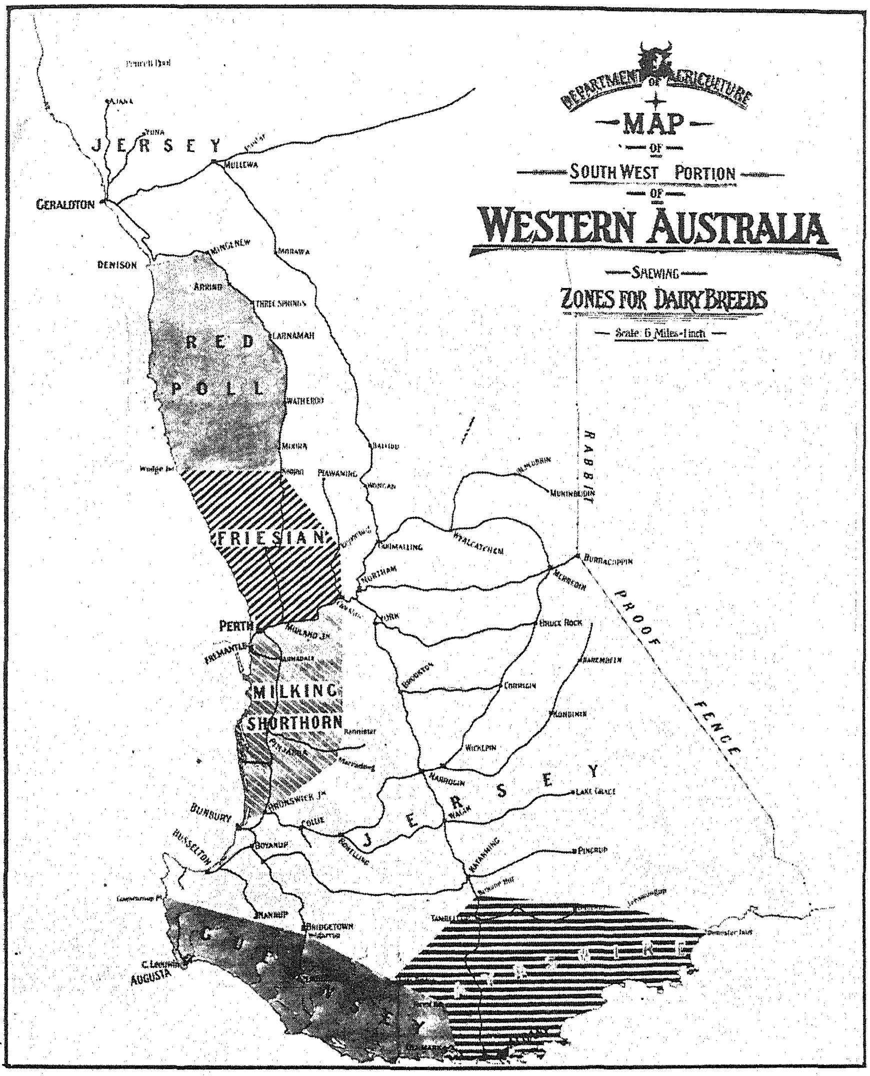
We have also in Australia instances of the great improvement made in Merino sheep, due to the long period of years of concentration in breeding by the use of high quality Merino rams; and in this respect the Merino sheep-breeder goes still further in his desire to concentrate and uses rams of one particular "line" of blood, whether it be "Peppin," "Murray," or "Koonoona" blood. We can imagine the horror of a Merino sheep-breeder in viewing the matter of using various breeds of rams with each generation, such as the "Romney Marsh," then "Lincoln" followed by "Corriedale," and then back to "Merino" again. The breeders of poultry, apart from show breeders, the men who are breeding for egg production, would not dream of mixing the breeds—using Leghorn roosters with Orpington hens and then, perhaps, Cochin China roosters subsequently. The same applies to horses and dogs; but, unfortunately, too long the average dairy farmer has been adopting the practice of mixing the breeds.

The zone system, which has been accepted in Western Australia, is designed for the purpose of having a concentration of blood of one particular breed in each zone or district, using as a basis pure-bred sires of the breed ex tested dams with production records above standard. The average dairyman cannot buy high production cows, but, with such a policy of grading up, results in regard to production and type will be attained ere long by using such sires on common ordinary cows to commence with.

The Western Australian Government has made it possible that pure bred for production bulls will be within the reach of every dairyman, and a policy has been set out accordingly.

Having convinced farmers that pure-bred sires are essential to progress, the natural corollary is zones for their operation. The breeds have been selected according to two main conditions, namely, suitability of country (climatic and pasturage conditions), and work required of the breed—"milk" or "fat." The districts near the metropolitan area, as the climatic and pasturage conditions are suitable, have been reserved for breeds such as the Milking Shorthorns and Friesian, on account of the large amount of milk these breeds give in comparison with the others; and the zones or districts at a great distance from the metropolitan area--which, in Western Australia, the land of great distances, will naturally be for butter production—have been reserved for the Jersey, Guernsey and Ayrshire breeds, according to the climatic and pasturage conditions.

In defining the zones, the writer conferred with the breeders and Royal Agricultural Society of the State, and the accompanying map is the result of their final deliberations, and has their unanimous support.



The zone system of breeding, apart from the concentration of one blood, is of great economic value in the mutual exchange of bulls by farmers when it is necessary to make a change in their dairy sires, all the farmers in the zone or district being owners of bulls of similar breed, thus saving "forced sale" of the old bull, often at a sacrifice, and there is no fresh outlay for a new bull, no high freight costs but merely "You take my bull, I take yours," and the added advantage of being able to again secure a bull which has been breeding high producing daughters. From the local Agricultural Show point

of view there is an improvement: districts become noted for their cattle, Jersey, Guernsey, etc., as the case may be, and this acts obviously to the commercial advantage of that district. Every farmer has one breed in a zone: greater interest will be shown in cattle exhibits; complete and full number of classes, and pens of heifers, cows (milking and dry), groups, etc., with big entries in each, instead of a few animals of each breed with no competition and no interest.

When the scheme was first launched in Western Australia only Milking Shorthorn, Jersey, and Guernsey cattle breeders had availed themselves of the official herd-testing scheme conducted by the Government, but, as the result of a series of conferences, the Ayrshire, Friesian, and Red Poll breeders intimated they were willing to submit their herds to the official test. The result is that, to-day, Western Australia has practically every registered breeder submitting his herd to the official test, and, as the State's dairy cows increase, it is anticipated that the stud breeders will be in a position to supply registered pure-bred bulls ex tested dams, which are the only bulls that are required, and in sufficient quantity to meet the requirements of the State.

It is recognised that Western Australia is in a fortunate position in regard to introducing such a movement, as, with the big dairying development which is in hand in connection with the group system of land settlement, there were comparatively few vested interests to be considered, and in introducing such a measure it would be easier in a new State than in an old one; but, however, it will be conceded that zones become the obvious corollary in the use of pure bulls, and are practicable. To have evaded the advantages of such a unique opportunity would have been criminal from an agricultural standpoint.

The conclusion to be drawn is that increased average cow production is of the greatest importance to the dairying industry of Australia to-day, and the principal factors in bringing this desirable improvement about is by the use only of *pure "tested" dairy sires* and a definite policy of "grading up," such as will follow by their operation in *zones.*

Conclusions.

1. The improvement of average cow production is without doubt the greatest factor in the progress of dairying in Australia to meet the increased cost of production. The answer to the increased cost of production is increased unit production.

2. The principal factors in improving average cow production are: "Breeding," "Feeding," and "Weeding."

3. "Breeding" is the most important, as it is the foundation stone upon which to build a profitable herd.

4. Practically all instances of increased milk and fat production in herds are shown to be the result of the use of better sires.

5. With common average cow herds a definite system of "grading up" becomes necessary. The slap-dash methods of mixing the breeds is fatal to improve production, owing to a conflict of the breeds with each mating.

6. Pure "tested" bulls or "standard" bulls are shown to be the great influence in increased production from results of all Herd-Testing Associations' records and statistics. Probably the most remarkable instance on record regarding proof that pure sires and production go hand in hand is shown by the recent figures published by the Department of Agriculture of the United States of America, as follows: "The 48 States of the Union were divided into four groups of 12 States. The first 12 States, with an average

of 51 per cent. pure sires, record an average production of 410 gallons of milk per cow per annum; the second 12 States, with an average of 31 per cent. pure sires, showed an average production of 330 gallons of milk per cow per annum; the third 12 States, with an average of 19 per cent. pure sires, averaged 260 gallons of milk per cow per annum; and the last 12 States, with an average of only 12 per cent. pure sires, showed an average production of 200 gallons of milk per cow per annum." These figures, representing as they do the result of the production of nearly 25,000,000 dairy cows, are most eloquent in showing that increased production follows the use of pure sires.

7. If we can increase the average production of each cow in Australia by ten lbs. fat per cow per annum, it is worth 2¼ million pounds sterling per annum.

8. The leaders of the dairy organisations in Australia might very profitably turn their attention and utilise their organisations in the direction of the improvement of average cow production. Australia's average cow is a low producer compared with cows of some of the leading dairying countries of the world.

9. The first step towards improved production is the *use of pure bulls;* the second step is the *use of pure "tested" bulls,* and the third step is the *use of pure "tested" bulls in zones.*

10 Purity without production is as a bucket without milk.

11. There is no value in using pure "tested" bulls if a change of breed is made with each sire used. A zone system of breeding is actually in operation in all the best dairying districts of Australia and other dairying countries.

12. The highest average cow production in the States of America synchronises with the States which have the highest percentage of pure bulls.

13. "Grading up" creates more interest to the dairy farmer, and combines pleasure and profit.

14. The high plane of Australia's Merino sheep is due to the concentration of one breed; and zones or districts afford a means of easy exchange of bulls, systematic "grading up," and greatly increased interest at provincial shows in each of the zones.

15. Western Australia has adopted the Zone System. To have missed the unique opportunity which presented itself would have been an agricultural crime.

WHITE CLOVER.

(*Trifolium repens,* Linn.)

W. M. CARNE, F.L.S., and C. A. GARDNER.

White, or Dutch Clover is not one of our common clovers. It is a perennial, and requires moisture during the summer months in order to survive. For this reason it is not very widespread, and is only naturalised in the moister waste places, summer pastures and lawns of the South-West districts. It has not spread into the drier areas.

In suitable localities, *i.e.,* where the soil is moist throughout the year, it is a most valuable pasture plant. Besides being one of the most nutritious of the clovers, it is one of the few perennial species that can be grown with Paspalum. The plant is very palatable, and stock are fond of it pre-

ferring it to most other pasture plants. White Clover succeeds better in heavy or loamy soils than upon sand, but does not grow well in soils that are inclined to cake hard on the surface, since the creeping stems cannot obtain a foothold in such soils. The plant makes its best growth during the Spring and Summer, and develops but little during the Autumn and Winter. In this respect it is later than Subterranean Clover. The species is of creeping habit, and does not attain any great height, seldom reaching one foot, but it possess a strong leaf growth, and recovers quickly after stocking.

For the moister parts of the South-West it makes an excellent pasture plant, and where the conditions are sufficiently moist it should be one of the principal constituents of the pasture. Owing to its lowly stature it can only with difficulty be converted into hay. As a pasture plant it may be grown as a pure crop, or mixed with other species. Top dressing (with phosphatic fertilisers) is essential if good results are expected.

A good pasture can be made from Paspalum (Water Couch), White and Strawberry Clovers, in heavy soils.

The following mixtures are recommended for drained or semi-swamp lands:—

For Spring sowing, Paspalum, White Clover and Lucerne. Where Spring sowing is not practicable, Paspalum, with Subterranean Clover, Alsike Clover, Cow-grass, and White Clover, sown in the Autumn.

In soil which is swampy or undrained, a good mixture is Lotus Major and Paspalum with which White Clover may be included. Spring sowing is advisable here.

For pure crops 5lbs. of seed per acre is sufficient; when sown with Paspalum 2lb. per acre, and, for mixtures containing other clovers, one to two pounds per acre will be found satisfactory.

Good results with White Clover have been obtained in Spring sowing one year after Paspalum, by distributing the seed on the surface, and allowing sheep to tread it in.

Mr. Prowse, of Capel, recommends White Clover as a pure crop stocked judiciously, since, owing to their partiality for the plant, stock are apt to select it from mixed pastures and keep it down.

The seed is very small, 40,000 to 50,000 go to the pound, and 60--65lbs. to the bushel. They are heart-shaped, flattened, smooth and yellow, usually tinted brown, or occasionally assume a greenish hue. Good germination should give 90 per cent. or more. The germination of samples received by the Department average 79 per cent., with a range of from 50 to 90 per cent.

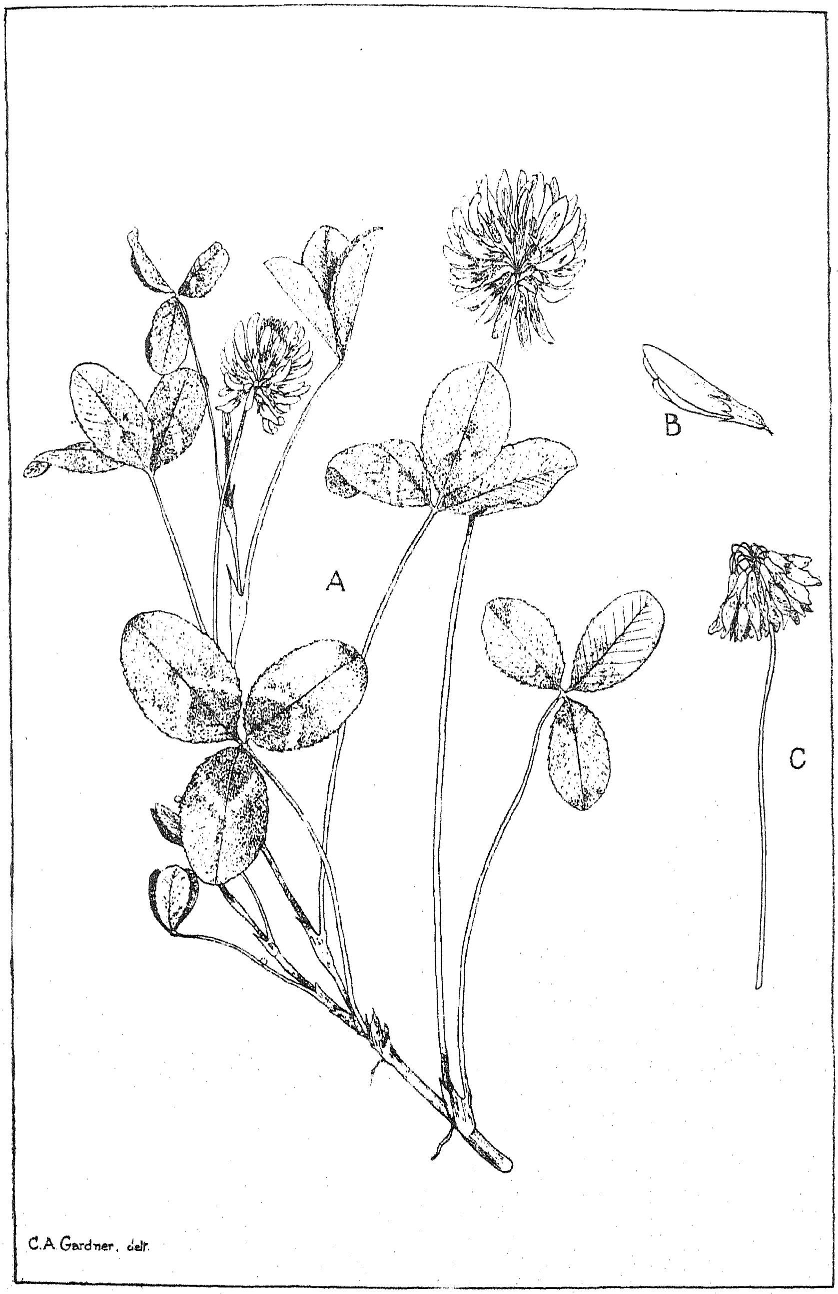
In purity the seeds tested here average 97 per cent. The foreign seeds in these samples range from nil to 9,230 to the pound, averaging about 4,700. The principal foreign seeds consist of other clovers, mainly annuals: Rib-grass, Fathen, and Sorrel.

The main sources of supply are England and New Zealand.

Description of Plant.

A hairless perennial with prostrate rooting stems. Leaflets three, broadly ovate and usually marked with a crescent-shaped white stripe (see illustration), and finely-toothed margins, the veins not very conspicuous. The flowers are white, but are pink when in bud, and are loosely arranged in a head consisting of usually 30—40 flowers. The stalk of the head is longer than the leaves. Pedicels short and slender, reflexed after flowering. Calyx glabrous, 10-nerved with acute teeth usually erect. Standard twice as long as a calyx. Pod enclosed within the calyx, oblong, slightly constricted between the three or four seeds.

The plant is a native of Europe and Asia.



White Clover.
(*Trifolium repens,* L.)

Explanation of Plate:
A.—Plant.
B.—Flower (enlarged).
C.—Fruiting head (enlarged slightly.)

HORTICULTURAL NOTES.

Seasonal Work for July, August, and September.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

JULY.

In deciduous orchards the principle work claiming attention during this month is pruning, and though there are some growers who prune very lightly and others whose practice is just the opposite, whatever style is followed, it is essential that the work should be done in its proper season: so in spite of wet and cold weather which makes, at times, the work anything but pleasant, the secateurs must be kept going. In referring to the "proper season," I do not mean that the trees would suffer direct injury if the pruning is done late in the season, for, as a matter of fact, winter pruning can be carried out right up to the time when the buds are ready to burst without injuriously affecting deciduous trees, but the main reason for performing the bulk of the work in June, July, and early August is the necessity for cleaning up, in its season, the work of that season, and not allowing it to overlap the next season's operations. If pruning is delayed in winter, cultivating and spraying are delayed in spring, and in any period of the year, if work gets behindhand, it becomes very difficult for the worker or workers, to draw level again.

As I have before stated in the Horticultural Notes in the *Journal*, there are nearly as many styles of pruning as there are operators, but in spite of wide variations, there are certain fundamental principles underlying the practice which must be followed by all, and the main one is undoubtedly to Prune for Profit. To achieve this, each tree must be treated in such a way that it will produce a maximum quantity of fruit of good quality and marketable size. Leaders must be spaced so as to allow light and air to penetrate freely to every part of the plant, while guarding against over exposure, which results in sun burned bark and fruit. In the tree's earlier years care must be taken by moderately hard pruning to force growths from buds all along each leader's length and avoid bare spaces so often noticeable, but so unsightly and unprofitable, and in later years equal care must be taken in guarding against overcrowding of bearing buds and shoots which may produce many fruits, few of which are of good quality or marketable size. I am not ambitious enough to think these few notes will serve as a useful guide to anyone not conversant with the art of pruning, but I would strongly advise those growers who have little or no knowledge of it to communicate with the Orchard Inspector who supervises their particular district and arrange with him to give a practical demonstration and advice on the spot. More information can be gained in one hour by a beginner in this way than in a week spent in studying a text-book; but once a conception is gained of the habits of fruit trees and the manner in which the fruit is borne, from an explanation at, and demonstration on, the tree itself, a good text-book becomes a valuable aid and helps toward a better understanding of that vital principle "Pruning for Profit."

Wherever the land is not too sticky, planting deciduous trees should be pushed on with during this month. If the land is too wet for planting operations when the trees arrive from the nursery, every care must be taken to heel them in in moist (not wet) soil to prevent the roots drying out.

Citrus growers will be engaged this month in harvesting the crop of oranges; at time of writing (2nd June, 1925), it would appear that very few

oranges will be exported from Western Australia to London this year. The bad condition in which much of the fruit arrived last season and the low prices consequently received, have made many growers dubious about risking further consignments this year. So far as I have been able to judge, I consider the orange crop, on the whole, is lighter this season than last, but there is quite a sufficient crop to supply the local market and also provide a few thousand cases for export. It is to be hoped that some will be sent, for in a good cropping year, if the whole of the produce has to be placed on the local market there will be some very low prices recorded, and it is well to keep in touch with the London market by sending some forward each season.

I hope all orange growers when gathering fruit this year, whether for export or local market, will reduce rough handling to a minimum, for there is no doubt that our want of success in shipping oranges to London has been to a fairly large extent due to the rough treatment the fruit received at time of picking and packing.

It is to be hoped that all growers whose orchards are infested with San José Scale have followed the advice tendered in the notes published in the last issue of the *Journal*, and have already sprayed the trees once thoroughly, but if from any untoward circumstances this very necessary work has not been done, no time should be lost in completing it, for it is essential that all infested trees should be thoroughly sprayed at least twice during their dormant period. The Inspectors at the Ports this year had to refuse a permit to ship a number of cases of apples that came forward infested with San José Scale, and the growers who suffered need not have done so if they had only sprayed the trees thoroughly last winter.

All winter fruits should be watched carefully for signs of fruit fly infestation, and all fruit found to be infested should be destroyed by boiling.

AUGUST.

Pruning and planting of deciduous trees should be completed by the end of this month, and wherever the soil will work up without being puddled or rendered sticky, spring ploughing should be pushed on with.

Obtain scions for grafting purposes from bearing trees while they are dormant, during the early part of this month, and bury same in soil in a cool place to prevent the buds from bursting. Scions so treated will keep in perfect condition for grafting until the end of September.

Apply the second spray for San José Scale towards the end of this month, taking advantage of any fine weather which may be experienced. Where San José Scale and Woolly Aphis require treatment in the same orchard, use Black Leaf 40 and Lime Sulphur, as advised in notes for May in the previous issue of the *Journal*.

Continue the search for, and destruction of, citrus fruits infested with fruit fly, and carefully examine ripening loquats for traces of the pest. The weather in this month is usually too unsettled to allow of much success attending an application of poison bait to the trees, but should citrus fruits or loquats be found to be infested, bait should be applied on the first fine day afterwards.

Orange aphis was very prevalent last year; in fact it was present in many places in an unusual degree right through the summer. It will again commence to show up at the end of this month, and should be treated with Black Leaf 40 and soap, using 1lb. of the former and 3lbs. of the latter in 80 gallons of water.

SEPTEMBER.

This month is one of the busiest of the whole year for the fruitgrower.

Ploughing, cultivating, hoeing, spraying and grafting are the major operations requiring attention, and there are many minor ones which help to prevent the time from hanging heavily on the orchardists' hands.

Amongst the major operations mentioned, attention to Pear Scab (*Venturia pirina*) is one of primary importance, and to refresh the memory of those growers concerned, I recapitulate the advice given in the notes for September of last year:—"In districts where Pear Scab (*Venturia pirina*) is prevalent, it is imperative that the first spraying with Bordeaux mixture—6lbs. bluestone, 4lbs. lime, and 50 gallons of water—should be applied during the pinking stage of blooming; that is, when the majority of the blossoms are showing as a pink bud, and when only a few have burst into petals. If this time of spraying is missed, any number of sprayings later in the season will not give a good result. In many districts in this State, in ordinary seasons, the pinking stage spray is all that is required, but when wet weather continues a second spraying, after the fruit has formed, becomes necessary, using the same mixture, and in abnormal seasons, even a third may be needed some time later. When this last occurs, lime sulphur, at a strength of 1 gallon in 40 gallons of water, should be used, because Bordeaux applied at that stage of the fruits' growth may cause russetting.

Should there be any difficulty in obtaining freshly burned lime, 9lbs. of Washing Soda may be substituted for the 4lbs. of lime, making Burgundy Mixture instead of Bordeaux. A ready-made Bordeaux, "Schloesing's," has been used with very satisfactory results by some growers, while others have experienced burning of foliage following the application: from inquiries made it would appear that it is advisable to test the mixture with litmus paper or a clean knife before using, and if found necessary, sufficient washing soda should be added to neutralise the burning effect of the bluestone. The proportions to use and methods of mixing "Schloesing's," are supplied by the vendors with the material.

Where apple trees were affected last year with Powdery Mildew, spray with Atomic Sulphur, 1lb. in 10 gallons of water after the blossom petals have fallen.

Spray for Orange Aphis during this month.

Bait regularly for fruit fly from now onwards throughout the spring and summer in every orchard in infested districts as soon as the various fruits become sufficiently ripe to serve as a depository for the eggs of the pest.

Planting of citrus trees should be completed this month.

Graft over all old, obsolete varieties of pear and apple trees to varieties which will pay for their upkeep in the orchard, but only do this if the stocks are sound and healthy; an unthrifty stock will never result in a good tree, no matter how well the grafting is done. Use the strap graft, and if not familiar with it, ask the Orchard Inspector in your district for a demonstration.

Apart from low milk records, circumstances frequently arise which compel one to weed out cows from the herd; and the keeping of the herd up to anything like a standard is no light task. We have yet to prove that purchased stock are, or will do, better than stock raised on the farm, provided good judgment is exercised and great care taken in selecting it.—*Journal of Ministry of Agriculture.*

THE STICKFAST FLEA AND ITS CONTROL.

W. T. RICHARDSON,

Poultry Inspector.

For the last two years the Stickfast Flea has been giving considerable trouble to the poultry farmers in the Welshpool district, so much so that a number of them were anxious to dispose of their properties on account of the extra amount of labour and expense incurred in trying to combat the flea with practically no results.

Mr. S. Dolman, of Division Street, was in that unenviable position. Those of my readers who have been visited by this pest and have their few fowls to treat will realise what it means to have to handle over 1,800 birds like Mr. Dolman did, by treating their heads with oil and spraying the fowl-houses with phenyle solutions, etc. If one application were sufficient to eradicate the flea it would not be such a difficult proposition to face. Experience shows that very frequent applications have to be resorted to if this pest is to be kept under control. Moreover, all poultry owners know that the more a hen is handled, particularly pullets, the less eggs will she produce.

In the spring of 1924 Mr. Dolman decided to put cemented floors in his fowl-houses. He experimented with a few of them and found the results so encouraging that the balance were soon similarly treated. A thorough inspection of his yards was made in February last, and amongst a large number of birds caught only one was found so slightly infested that his premises could be considered clear of Stickfast Flea. A further inspection in April after the first few showers, when this parasite is at its worst, gave the same gratifying result as on the previous occasion.

Mr. T. Boulter, Division Street, Welshpool, who carries about 900 head of poultry, was similarly placed. All or any treatment seemed of no avail. When he saw the results obtained by Mr. Dolman through cemented floors he decided to treat his fowl-houses in a like manner. An inspection of his yards in February last showed most interesting as well as instructive results. It must here be mentioned that some of his yards are in double sets and adjoining, with just the 2-inch netting in between, and some had the houses with cemented floors; others with just the bare sand. The birds in the yards with cement floors were quite free from flea, but those in the adjoining yards where the floors of the houses had not been cemented were in a very bad state of infection.

Since the above date Mr. Boulter has done the floors of the rest of his fowl-houses.

In April last a second inspection of this farm was carried out with the following notable results:—

The birds found free of infection in February last were still clean. Those in the yards where the floors of the houses had since been cemented were in various degrees of infection, *i.e.*, from clean to very bad according to the length of time the hard floors had been down. These remarkable results were obtained without recourse to treating the head of a single bird.

Mr. J. Davey, Division Street, Welshpool, adjoins the above property and has been poultry farming for a number of years. All houses were cemented shortly after their erection and no flea has been detected amongst his birds, with the exception of a brood of young chicks that were on free range and did not camp on hard floors.

These few examples, taken from a larger number, go to demonstrate that cemented floors are the most efficacious, the most lasting, and therefore the cheapest means of controlling the Stickfast Flea. Moreover, all fowl droppings can be saved and the birds have damp-proof houses, and, in consequence, are less liable to colds, roup, etc.

After a floor is cemented, about half and inch of sand should be spread over it. It will prevent—

(a) The birds standing directly on the cold cement in winter;
(b) The droppings from adhering to the floor; and
(c) Any egg from cracking that is laid off the perches.

The latter should not be more than 18 inches from the ground, 15 inches for preference.

Cement.

One bag weighs 125 lbs.; contains $1\frac{1}{3}$ cubic feet, equal to (approx.) 2 kerosene tins full. (Cubic capacity of 1 kerosene tin: 0.69 cubic feet.)

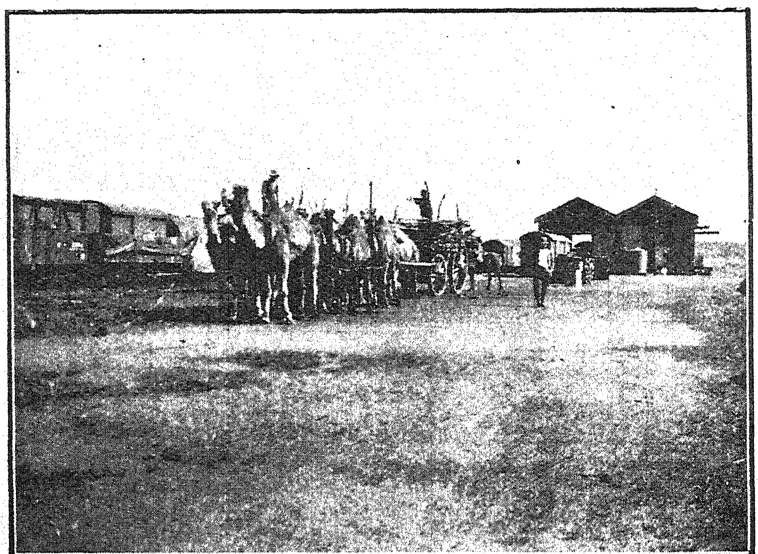
Proportions.

1 part cement.
4 parts clean sand or small gravel free from clay.

One bag cement in above proportion will cover:—

1 inch thick ..	.. 74 square feet.
$1\frac{1}{2}$ „ „ ..	.. 42 square feet.
2 „ „ ..	.. 37 square feet.

For houses up to 12ft. by 6 ft. of surface, 1 inch thickness of floor is recommended. For houses over that size $1\frac{1}{2}$ inches to 2 inches, according to size.



LIMITING FACTORS AFFECTING PLANT GROWTH.

W. P. CASS-SMITH, B.Sc.Agr.,

Agricultural Adviser.

A growing plant may be likened to a manufacturing concern, in which raw material drawn from several sources is subjected to a series of processes, until finally the finished article emerges. Provided the work proceeds smoothly the output is maintained at a regular rate, but if a stoppage occurs in any one department production ceases until such delay is made good.

The raw material of plant life is the food supply, which, on entering the plant, is gradually manufactured into new tissue.

If we trace the growth requirements of a wheat plant we can see where stoppage is most likely to occur. As the plant is alive it requires, *firstly,* an air supply to enable it to breathe. Breathing, however, is not confined to the stem and leaves, but takes place through the roots also, and hence the soil must be well aerated. *Secondly,* it needs a regular supply of raw food materials from which new tissue will be produced. Food is drawn from two sources—the air and the soil.

From the air the plant obtains carbon, which forms between 40 per cent. and 50 per cent. of its dry weight, and it has been calculated that an acre of wheat removes at least one ton of this substance from the atmosphere during its growth. As the supply of carbon in the air is unlimited it will not concern us here, and so we come to the second source of food—the soil.

When green, a wheat plant contains about 75 per cent. of water, which gradually decreases towards harvest, till only 16 per cent. remains. Water is thus one of the primary requirements of the plant from the soil.

Besides water there are seven substances essential to growth which the plant obtains from the soil, but in practice we find that only three of these—nitrogen, phosphorus, and potassium—are usually lacking. The supply of these in the soil is therefore of prime importance, as without them the plant cannot live.

Although the atmosphere contains about 80 per cent. of nitrogen, the plant cannot utilise it in the gaseous form. In the soil the plant obtains its nitrogen from two main sources—from the decaying vegetation of pre-existing plants, and from certain minute organisms of a specialised nature, which fix nitrogen from the air and convert it into a form readily available to plant life.

These organisms are of two kinds—those living in conjunction with leguminous plants, obtaining their food from the legume, and in return giving back nitrates, and those which live a separate existence. It is with this latter group of nitrifying bacteria that we have to deal.

The nitrifying bacteria in the soil feed on the vegetable matter present, and the energy they obtain from this source is utilised in changing atmospheric nitrogen into a form readily available for the plant. The value of this process to the farmer cannot be over-emphasised, as if properly controlled the need for nitrogenous manures is largely dispensed with on many of our soils.

To do their work properly these bacteria need air for breathing, a fair temperature, water to remove the products of their reaction, and the absence of acidity in the soil, which stops the reaction.

The control of this process is very largely in the hands of the farmer, and will be referred to later.

The action of nitrogen on the plant is very marked; it increases the vegetative or leafy portions and lays the foundation for a healthy, vigorous growth.

The supply of phosphorus is deficient in almost all West Australian soils, this deficiency being made good by the universal application of superphosphate. Phosphorus greatly increases the root development, and thus the drought-resisting powers of plants; and, in addition, makes them ripen earlier. In all except the lightest soils there is a sufficiency of potash, but on the latter dressings of muriate of potash may be beneficial.

Potash has a great influence on grain formation, and increases the proportion of grain to straw.

These, then, are the raw materials which the young wheat plant will utilise for its growth. They cannot enter the plant, however, unless they are in solution in water, which must therefore be conserved. In solution, they diffuse through the walls of the root-hairs and are transported to various parts of the plant, where after a series of chemical changes they are combined with carbon to form the different constituents of plant tissue.

The chemical changes which the raw-food materials are subjected to in the plant are greatly affected by temperature. The higher the temperature, up to a point, the faster these changes go on, and hence the rate of growth is quickened. In the laboratory growth ceases when the temperature is raised too high; but under field conditions this need not be feared. In practice, therefore, a high soil temperature will quicken the first growth of the wheat plant and make for earlier maturity.

The requirements for growth traced so far have been the presence of certain factors without which the plant could not live. There are, however, other factors upon the *absence* of which in the soil growth depends: these are injurious factors.

The injurious factor most common in this country is salt, and its effect upon plant growth is well recognised.

There is another harmful factor, which is more easily corrected (by the use of lime)—this is soil acidity.

We have now traced the requirements of the wheat plant during its growth and found that it needs—

(1) air for breathing;
(2) a food supply of nitrogen, phosphorus, and potash;
(3) a fair temperature, which regulates certain biological processes in the soil, and chemical changes in the plant;
(4) water to carry the food to the plant and to form a considerable part of its composition; and
(5) an absence of injurious substances which are toxic to the plant.

These, then, are the primary factors upon the presence or absence of which the growth of the wheat plant depends. As each one sets a limit to crop production, they are called "limiting factors."

It will be noticed that their action on the plant may take place in two ways—either directly, as in the case of air supply in the soil affecting the

respiration of the plant, or indirectly by affecting the conditions in the soil under which plant food (especially nitrogen) is produced, which in turn affects the plant growth.

Returning to our analogy between factory and plant, we saw that stoppage in any department delayed the whole manufacturing process and the output of the finished product. Similarly, if one of these limiting factors is adversely affecting the plant, the whole process of plant growth will be checked.

In order to understand this fully, let us consider the three limiting factors—air, food supply, and water—together, and their effect upon the plant under certain conditions.

Suppose the soil is rich in plant food, contains enough water for plant requirements but insufficient air, then the respiration of the plant is affected, and it cannot make full use of the rich supply of plant food in the soil. Air supply in this case is setting a limit to crop production.

The control of these limiting factors is largely in the hands of the farmer, as much depends upon the preparation of the seed-bed and correct use of manures. A good seed-bed should fulfil the following requirements:—

Firstly, it should contain an adequate air supply.

Secondly, it should contain a sufficiency of water, but not excess.

Thirdly, it should allow the nitrogen-fixing bacteria to carry out their beneficial work.

These requirements are observed by the following cultural methods:—

Fallowing early to get the benefit of winter rains and to open up the soil to the air.

Cultivating after fallowing (a) to destroy weeds, which use up the water and food supply; (b) to keep the soil well stirred, allowing air to enter and preventing water escaping, and (c) to allow the nitrogen-fixing bacteria in the soil to do their beneficial work.

Where the soil has a tendency to become water-logged, drainage should be carried out. When excess water is present the air supply to the plant is cut off, the soil is cold, carbon dioxide accumulates and adversely affects the plant by stopping nitrogen fixation.

Coming now to the control of plant food limiting factors, we find that, except on the light soils, superphosphate is the only manure needed, and applications of between 90 lbs. and 1 cwt. of this substance per acre will be sufficient to correct this deficiency. On the lighter soils potash may set the limit to plant growth, and a dressing of ½ cwt. per acre of muriate of potash will be beneficial. Acid soils containing toxic substances, which fortunately are few in our State, will be greatly benefited by an application of lime. Lime in these soils neutralises the acidity, liberates the plant food, and allows nitrogen to be stored by the organisms already mentioned.

From the control measures mentioned it will have been noticed that only under a good farming system, where fallowing, cultivation, and the judicious use of manures combined with drainage where needed, are carried out, can the requirements of plant growth be adequately met.

When this is realised and put into general practice our average yield will increase, and we shall occupy a higher place among the wheat-producing countries of the world.

CRACKING AND RUSSETING OF DUNN'S AND OTHER APPLES.

W. M. CARNE,

Botanist and Plant Pathologist.

In the September, 1924, issue of this *Journal* it was stated that the cracking of Dunn's and other apples was associated with a fungus (*Coniothecium* sp.). Growers were invited to conduct experiments to test whether the control of the fungus by spraying with fungicides would reduce the occurrence of cracking. The following is an outline of the experience gained during the past season:—

Infection Experiments.—Sound young fruit ¾ to 1 inch in diameter were infected with pure cultures of the fungus. The results were negative, neither russeting nor cracking nor other injury were produced. When the apples were injured the fungus established itself on the broken surfaces.

Field Occurrence of Russeting and Cracking, 1924-5.—The wastage from this cause was remarkably light last season, even on trees badly affected the previous year. Where it occurred it was usually confined to unthrifty trees.

Spraying Experiments.—Spraying experiments with lime sulphur were carried out by growers at Mt. Barker, Bridgetown, and Karragullen in conjunction with this Department on the lines indicated in the *Journal.* No definite reduction of the trouble could be traced to the spraying. The affected trees, whether sprayed or not, were almost invariably those of low vigour and with light crops.

Conclusion.—On the evidence available from the last few seasons, it would appear that the russeting and cracking of Dunn's and other apples is connected with climatic and growth conditions, and is not due to parasitic fungi. The fungus (*Coniothecium*) appears to be purely secondary, following but not causing the trouble.

It has become very marked that the cracking is most serious on trees which are not vigorous and bear light crops. It also varies from season to season, being apparently most marked in years of early and dry summers, and least when the summers are late and the early summer is relatively moist. This all points to the trouble being essentially one of sap movements in the plants. It is evident that little can be done to control the seasonal occurrence of cracking. In regard to unthrifty trees, however, it is clear that anything which will induce a more vigorous healthy growth will reduce the amount of loss. What the causes of lack of vigour may be can only be determined in each particular case. Bad drainage is certainly one of the main factors, and probably the most important.

There is no evidence that spraying is of any value in controlling this trouble.

DISTRICT CROP COMPETITIONS.

COMMENTS BY THE JUDGES.

Following upon the publication of the results of the Royal Crop Competition in the last issue of this *Journal*, the Judges' reports of the District Competitions are published hereunder:—

WONGAN HILLS DISTRICT AGRICULTURAL SOCIETY.

In this competition entries were received from Messrs. R. B. Ackland, T. Bowen, Spencer & Sons, and C. Parker. Another entry had been received in addition, but this was cancelled prior to my inspection, which took place from the 9th to 11th November.

Though the entries were not numerous, there was considerable interest taken in this competition, and it was very gratifying to find a strong spirit of friendly rivalry existing between the competitors. Such a spirit must result in having a beneficial effect on the methods and yields of the district and should therefore be encouraged to the fullest extent.

Messrs. R. B. Ackland and T. Bowen, by obtaining first and second places in this district competition, also qualify for entrance into the Royal Championship Crop Competitions in Zone 2.

The two leading crops were distinctly better than the others. They were well-grown and even, and showed no signs of receiving any check during growth, and were estimated to yield 36 and 34 bushels respectively. Apparently the dry weather during July and September did not affect them.

The winning crop was remarkably free from disease, and was much freer from weeds than the second crop, and Mr. Ackland ascribes this freedom from weeds to the consistent use of sheep, which are run on the paddock both before and on the fallow.

Messrs. Spencer & Sons' crop was comparatively free from weeds, but lost points owing to a few grassy patches, and further, had 6 points deducted because of it being the first crop. This crop suffered in yield as a result of being grazed by sheep far too long and too late.

The general conclusion is that the highest yields will not be obtained when the crop is grazed.

The seed used by all competitors was graded, and in consequence the crops were free from barley.

None of the seed planted had been treated to prevent smut, with the result that this disease was noticeable except in the winning crop. The risk that farmers run through not treating their seed must be drawn attention to and the fact that dry sowing does not prevent smut.

The winner's success is ascribed to the fact that the land was early fallowed, and all operations connected therewith carried out thoroughly.

There is a great similarity of the method adopted by the winning and second crops; this can be seen from the following table, wherein the details of all competing crops are tabulated:—

Particulars.	R. B. Ackland.	T. Bowen.	C. Parker.	Spencer & Son.
Years cropped ...	Half 4th. Half 10th.	8th.	7th.	1st.
Ploughed ...	June, July.	July, August.	July.	3rd-4th week Aug.
Plough	Mould-Board.	Mould-Board.	Disc. Cultivator.	Mould-Board.
Depth	4-5 inch.	4-5 inch.	3½-4 inch.	Up to 4 inch.
Condition when Ploughed	Good.	Good.	Good.	Hard toward finish.
Other Cultivation	Cultivated with Springtyne twice in spring, again after rain in December. Planted with Combine Drill.	Cultivated with Springtyne 1st week October, cultivated (Sundercut) after rain in November. Planted with Combine Drill.	Cultivated with Springtyne three times during spring. Back ploughed in March. Planted with Combine Drill, 3rd week in April.	Cultivated with Springtyne in spring. Planted with Combine Drill.
Variety	Nabawa.	Federation.	Federation.	Nabawa.
Planted	Half third week April; Half third week May.	First week May.	3rd week April.	1st week May.
Rate of Seed ...	57lbs.	60lbs.	60lbs.	60-70lbs.
Treated	No.	No.	No.	No.
Graded	Yes.	Yes.	Yes.	Yes.
Super	110lbs.	110lbs.	90lbs.	70lbs. Fed off by sheep in July.

WONGAN HILLS DISTRICT—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Ackland, R. B., Wongan Hills	Nabawa ...	35	23	14	13	8	93
Bowen, T., Wongan Hills ...	Federation ...	34	20	12	12	9	87
Parker, C., Wongan Hills ...	Nabawa ...	24	20	12	12	7	75
Spencer & Sons, Piawaning	Nabawa ...	25	16*	12	13	7	73

* Deduction—6 points first crop.

I. THOMAS, Judge.

TAMMIN DISTRICT AGRICULTURAL SOCIETY.

The competitors were Messrs. H. C. Holden, Meakin & Son, H. F. Cooke, R. B. Nottage, and H. R. Hocking; five other entries had been received, but these were withdrawn prior to inspection.

The winning crop (Mr. H. F. Cooke, Tammin), was outstandingly better than the others. It formed part of 500 acres of the variety (Nabawah). This land had previously carried gimlet and a little morrel. The whole area was well-grown and even, and practically free from weeds. There was no bunt, though there were a few patches of "take-all."

The second prize crop (Meakin & Son, Tammin), was similar to the first in that it was part of 500 acres of the Nabawa variety, planted on land that had previously carried forest. The yields of the two prize winning crops were estimated to be 33 bushels and 26 bushels respectively.

Cultivation methods adopted were similar in both cases.

Mr. Hocking is to be commended on gaining third place, he being handicapped to some extent by the character of his soil, which was light and had previously carried tammar scrub, ti-tree, and mallee.

Only one competitor treated his seed for bunt. This was Messrs. Meakin & Son, who used the dry method. Portion of the crop was entirely free from bunt, but the other portion was affected as if it had not been treated. It is evident that there was some defect in the treatment of the seed sown on the affected portion, but sufficient details were not available to enable me to account for the apparent failure of the method.

The other crops with the exception of that of Mr. Nottage, were free from bunt, indicating the seed used was not infected. Farmers who sow with untreated seed are, however, taking a risk which is unnecessary and can be avoided by sound and practical methods.

"Take-all" in varying amounts was found in all the crops. This emphatically points to a serious danger which can be avoided by the adoption of a better farming practice which includes a systematic growth of oats, in conjunction with the wheat crop, and the planting of the wheat crop after instead of before the rain.

Though the yield of the winning crop is good, it is believed that it could be increased by the adoption of more cultivation of the fallowed land, and these competitions are likely to have the effect of bringing this about and thus increasing the average yields of the district.

Messrs. Cooke and Meakin & Son automatically become competitors in the Royal Championship Crop Competition, and in this way these results and methods can be compared with those obtained from competitors in other districts in the same zone with approximately similar conditions.

The following table gives the various methods of cultivation adopted by competitors for comparison:—

Particulars.	H. T. Cooke.	Meakin & Son.	H. R. Hocking.	H. C. Holden.	R. B. Nottage.
Yrs. cropped	4th.	4th.	7th.	... ...	4th.
Timber ...	Gimlet and a little Morrell	Gimlet and Salmon.	Tammar scrub, ti-tree and Mallee.	Gimlet and Salmon.	Gimlet and little Morrell.
Ploughed ...	June and July	June and July	July.	July.	July.
Plough ...	Sundercut.	Mould-Board.	Sundercut.	Mould-Board.	Mould-Board.
Depth ...	4 inch.	4½ inch.	3 inch.	4–5 inch.	3 inch.
Condition at time of Ploughing	Good.	Little too wet; boggy in patches.	Good.	Little too wet; inclined to be boggy.	Good.
Other Cultivation	Cross cultivated Sundercut immediately after ploughing. Cultivated prior to seeding. Planted with a hoe drill.	Cultivated Sundercut March and April. Planted with Combine Drill, with harrows attached.	Cultivated (Sundercut) Sept., Springtyne cultivated shortly after and again prior to seeding. Planted with disc drill.	Cultivated Sundercut, Sept., again in Mar. Cultivated with Springtyne prior to seeding. Planted with disc drill.	Cultivated with Tandem disc in Aug., again in Sept. Cultivated prior to seeding with disc drill.
Variety ...	Nabawa.	Nabawa.	Nabawa.	Nabawa.	Nabawa.
Planted ...	1st week May	1st and 2nd week May.	2nd week May.	Middle April and rolled.	4th week April.
Rate of Seed	70lbs.	55lbs.	52lbs.	50lbs.	62lbs.
Graded ...	Yes.	Yes.	Yes.	Yes.	Re-cleaned.
Treated ...	No.	Dry Method.	No.	Dry Method.	No.
Rate of Super	85lbs.	70lbs.	90lbs.	95lbs.	60lbs.

TAMMIN DISTRICT AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Cooke, H. F., Tammin ...	Nabawa ...	33	24	13	13	9	92
Meakin & Son, Tammin ...	Nabawa ...	26	23	12	13	9	83
Hocking, H. R., Tammin ...	Nabawa ...	24	22	13	13	8	80
Holden, H. C., Tammin ...	Nabawa ...	23	18	13	13	7	74
Nottage, R. B., Tammin ...	Nabawa ...	20	18	12	12	7	69

I. THOMAS, Judge.

KULIN AND DISTRICT AGRICULTURAL SOCIETY.

The awards made in connection with the Kulin and District Crop Competition are as hereunder:—

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
James, L. & R., Kondinin ...	Nabawa ...	30	22*T	14	14	9	89
Trotter, A., Gnarming ...	Queen Fan ...	28	23	13	13	8	85
Meikle, P., Kulin	Nabawa ...	26	19*F	14	14	9	82
Hawkins, W. J. B., Corrigin ...	Federation ...	25	22	14	13	8	82
Wayne, W. R., Gnarming ...	Federation ...	25	21*S	13	7	8	74
Enwright, P., Kulin	Queen Fan ...	23	19*F	11	13	7	73
Nicholls, R., Kondinin ...	Nabawa ...	23	18	12	12	7	72
Lenton, V., Gnarming ...	Federation ...	22	18*S	12	11	7	70

* Deductions :—F. equals first crop, 6 points.
S. equals second crop, 4 points.
T. equals third crop, 2 points.

Between the first four competitors there was little to choose, and the character of these crops was excellent.

Messrs. L. & H. James won the competition with a crop of Nabawa, which was very free from weeds, disease, and admixture, and exceptionally even in growth. The variety was tall strawed, well headed, and nicely filled with plump grain.

Mr. Trotter, who came second, grew Queen Fan, also very free from weeds, but which contained a little more admixture and disease than the former variety.

Nabawa was also grown by Mr. Meikle (third), and except for the slightly lower yield compared very favourably with either of the winning crops.

The variety entered by Mr. Hawkins was Federation, which lost points on evenness of growth and admixture, the latter being a common failing of all crops of this variety inspected.

Owing to a mistake made when seeding, Mr. R. Wayne lost points for admixture, Queen Fan having been sown with the competition variety Federation.

Mr. Enwright's crop of Queen Fan contained a fair percentage of bunt and was uneven in appearance.

Weeds, consisting chiefly of wild oats, mustard, and cockspur, were numerous in Mr. Nicholl's crop of Nabawa, especially in crabholes where the plough had failed to enter.

Bunt, loose smut, and "take-all" were also found, the latter being in fair proportion.

Similarly Federation grown by Mr. Lenton contained the above mentioned diseases, and in addition a large number of mixtures of other varieties.

Cultural Methods.—A study of the cultural methods adopted by the winners of first and second places in this competition may be instructive, and shows close similarity.

The land was fallowed early to get the benefit of winter rains, and to enable weeds to germinate. Cross ploughing was then carried out, and in one case the land was cultivated also, afterwards being left till seeding.

Sowing was carried out in May, the combine drill being favoured on account of the labour saving nature, and the excellence of the seed-bed it prepares.

The seed sown by Messrs. L. & R. James was carefully graded, the benefit being apparent in the extreme evenness of growth which resulted.

Cultural Methods adopted by:—

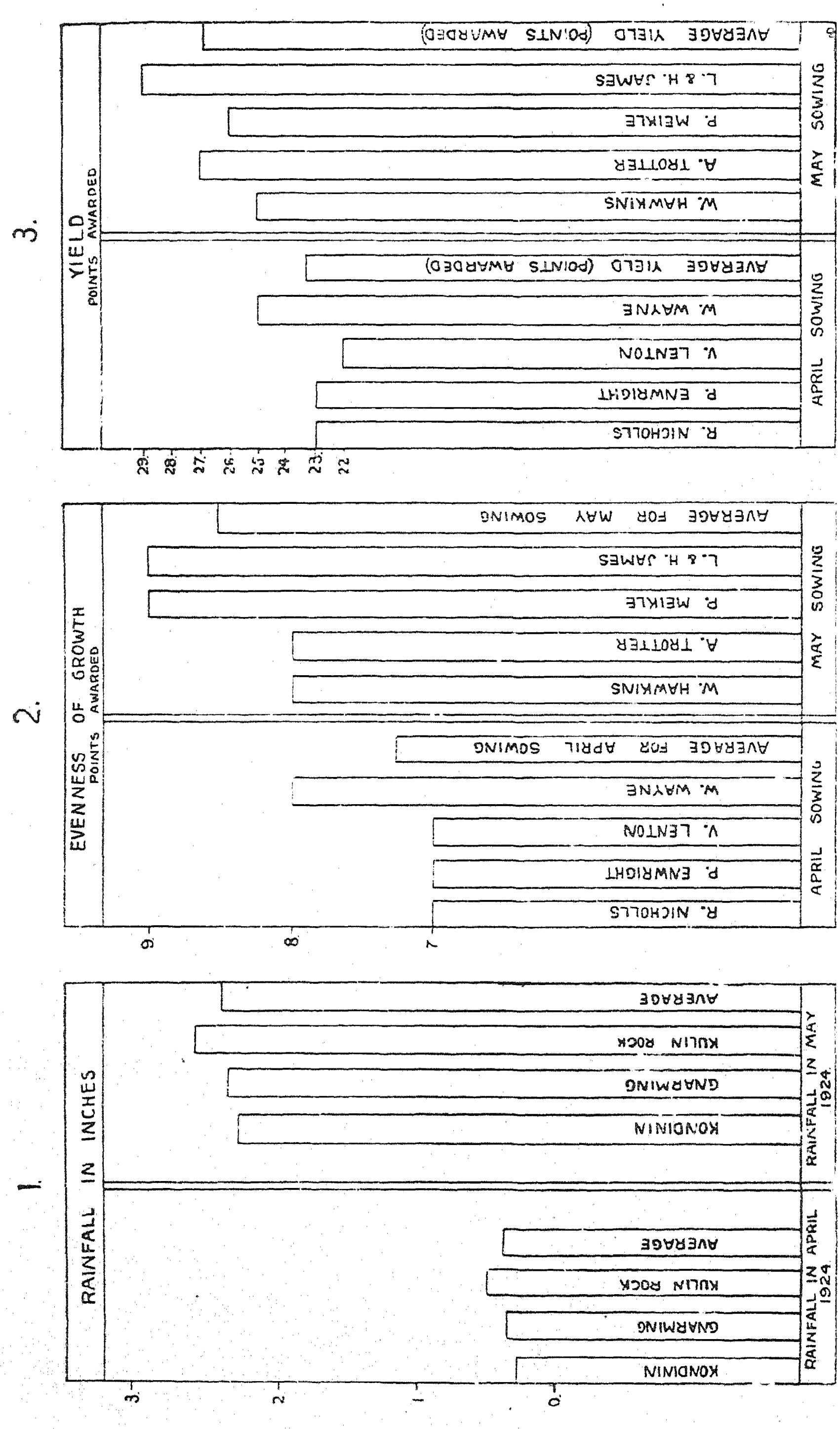
Messrs. L. & H. James:

Ploughed in July with disc to a depth of 4 inches.
Subsequent Cultivation: Cross disced in September, and springtyned at seeding.
Date of Planting: Early May.
Drill: Combine.
Rate of Seed: 45 lbs.
Rate of Super.: 56 lbs.
Pickled: Dry.
Seed Origin: Graded pedigree seed from Merredin Experiment Farm.
Harrowed after drill.

A. Trotter:

Ploughed in June with disc to a depth of 4 inches.
Subsequent Cultivation: Cross disced in August, cultivated with Tandem disc in October, and springtyned at seeding.
Date of Planting: Early May.
Drill: Combine.
Rate of Seed: 60 lbs.
Rate of Super.: 84 lbs.
Pickled: Wet.
Seed Origin: Local.
Harrowed after drill.

Although within the limits set by this competition, the variation in rainfall, over an average of years, is only slight, the time of planting varied considerably. On examination it was found that four competitors planted in April and the remainder in May. The rainfall during these months, taken at Kondinin, Gnarming, and Kulin Rock (which represents a fair average of the districts embraced in this competition) is set out in Graph No. 1. From this it will be seen that the average rainfall in April was 39, and in May 238 points. Thus the four competitors who planted in April did so under dry conditions, whereas the remainder planted during the wetter month.



The effect of April and May plantings upon the evenness of growth and upon the yield.

The effect of this is shown in Graph 2, which correlates the time of planting with the points awarded for evenness of growth. Thus the evenness of growth for April sown crop attained a seven point average as against an eight point average for May sowing.

The unevenness of crops planted under dry conditions appears to have had some influence on the yield.

In Graph 3 the points awarded for yields are plotted against the time of planting, with the following results:—

The average points for yield awarded to April sown crop was 23, and for May sown 26.

In the April sowings the only competitor who gained more than average points for yield was Mr. W. R. Wayne.

In this case it is interesting to find that cultivation took place after seeding, following rain, which resulted in the land not becoming set, and thus allowing better aeration and a more level germination.

The above conclusions, being the results of one year's observations only, cannot be regarded as conclusive, but it is pleasing to find that they lend a certain measure of support to the departmental policy of May planting (see *Journal of Agriculture*, Vol. 1, No. 1, page 62).

Conclusion.—The ultimate object of this competition is to raise the average of the State yield, by encouraging sound farming practice, and the initial success which has attended it is gratifying. Through the knowledge gained in the light of this competition, the tendency towards better cultivation is growing, and when this idea becomes more widespread the object set out above will be realised.

W. P. CASS-SMITH, B.Sc. Agric.

DOWERIN.

Immediately on arrival at Dowerin to judge this competition, I was impressed with the interest that was taken, not only by the competitors, but by the residents of the town—particularly by the secretary, who spared no effort to make my task as easy and as pleasant as could be. He had, as in previous years, arranged my itinerary and prepared a location map of the various competitors, thus enabling me to commence my tour of inspection without undue delay.

This is the third competition I have judged for this society, and it is very gratifying to find that increasing interest in being displayed. The effect of this upon the welfare and good name of the district must be beneficial because of the high yields which will be obtained in consequence, not only by the competitors themselves, but by the other farmers of the district who will, no doubt, follow their methods.

Of the ten competitors, one, Mr. F. Bear, of Minnivale, stripped his crop before my arrival, and that of Mr. Beresford was so obviously below the standard set for these competitions that it was not examined in detail.

The other competitors were Messrs. H. Jones, D. Place, A. W. Hewton, J. S. Jones, Allen Jones, Hughes Bros., C. E. Leehman, and J. Lindsay, and their crops were inspected on the 24th to 28th of November.

All the crops were grown on forest land which had previously been timbered with mainly gimlet and salmon.

It will be noticed by the points gained by the different competitors that the standard reached is now a high one and very uniform along the lines indicated by results of previous competitions in this district.

In view of the light July, and particularly September rainfall of from 35 to 70 points, spread over nine days, it was astonishing to find that the lowest yield was eight bags, whilst the yield of the winning crop was 12 bags.

The appearance of the crop gaining first place—Nabawa—was very striking, showing a solid mass of well-grown plants of nice stripping height, with well-filled heads, and practically free from disease.

The methods of cultivation adopted by the winner and other competitors are set out in the following table:—

TABLE A.—SHOWING METHOD OF CULTIVATION.

Particulars.	Hughes Bros.	Hewton, A. W.	Jones, Allen.	Lindsay, J.
No. of times cropped. ...	5 or 6.	At least 4.	6.	At least 6.
Timber. ...	Mostly Gimlet.	Gimlet and Salmon.	Gimlet and Salmon.	Salmon and Gimlet.
Ploughed. ...	July.	July.	June-July.	June-July.
Make of Plough	Mould-Board.	Mould-Board.	Mould-Board.	Mould-Board.
Depth. ...	4 inch.	4 inch.	4 inch.	4 inch.
Condition at ploughing time	Good.	Good.	Good.	Good.
Other Cultivation	Cultivated (Sundercut) in Sept. Harrowed after rain in Dec. Springtyne cultivated after rain in April, prior to seeding.	Cultivated twice in Spring with Springtyne T-bar, rolled six weeks before seeding. Cultivated prior to seeding.	Cultivated twice in Spring, once in early summer with Springtyne again in May. Planted with combine drill.	Cultivated in September with tyne cultivator, again during summer after rain, and again prior to planting. Planted with Combine Drill.
Variety ...	Nabawa.	Nabawa.	Nabawa.	Gluyas Early.
Planted ...	1st May, and harrowed.	2nd week May, and harrowed.	2nd week June, and harrowed.	3rd week May.
Rate of Seed	45lbs.	60lbs.	65lbs.	50lbs.
Treated ...	No.	Bluestone.	No.	Bluestone.
Super ...	110lbs.	70lbs.	130lbs.	90lbs.
Graded ...	Yes.	Re-cleaned.	Yes.	Yes.
Disease ...	None.	Trace "Take all."	Trace Smut.	Trace "Take all."

Particulars.	Place, D.	Jones, S. J.	Lehman, C. E.	Jones, H.
No. of times cropped	At least 5.	10.	3.	15.
Timber ...	Gimlet and Salmon.	Mostly Salmon and Gimlet, a little mallee.	Morrel, Gimlet and Salmon.	Salmon and Gimlet.
Ploughed ...	July.	July.	July.	June.
Make of Plough	Mould-Board.	Mould-Board.	Disc.	Mould-Board.
Depth ...	4 inch.	3½ inch.	4 inch.	4 inch.
Condition at ploughing time	Good.	Good.	Good.	Good.
Other Cultivation	Cultivated with Springtyne August and September. Twice cultivated and harrowed prior to drilling, again harrowed.	Harrowed after ploughing Cultivated twice in October again December, first week in June, and planted with Combine Drill.	Disced September, Springtyned and harrowed in October, cultivated again with springtyne, month prior to planting seed with Combine Drill.	Cultivated after ploughing (Sundercut). Before planting drilled and harrowed twice.
Variety ...	Federation.	Nabawa.	Gluyas Early.	Pennys.
Planted ...	2nd week May.	2nd week June, harrowed three days after.	3rd week May.	2nd week May.
Rate of Seed	60lbs.	45lbs.	55lbs.	45lbs.
Treated ...	Bluestone.	No.	Dry.	No.
Super ...	90lbs.	90lbs.	70lbs.	120lbs.
Graded ...	Yes.	Yes.	No.	Yes.
Disease ...	Trace Smut.	Traces loose Smut and "Take-all."	Trace "Take all."	"Take-all" patches and Bunt scattered.

The uniformity of methods adopted will be noticed. It will be seen that the cultivation consists of ploughing the land 4 inches deep, cultivating in all cases in spring and again in autumn. The winner also harrowed his land after rain in mid summer.

With the exception of the winner, the planting of the other crops was done not earlier than the second week in May; that of the winning crop was during the first week in May.

The rate of seeding ranged from 45 lbs. per acre in the case of the winner, to 65 lbs. in the case of Mr. Allen Jones, who obtained third place with a yield of 34 bushels and planted as late as the second week in June.

The fertiliser in all cases was superphosphate, 22%, ranged from 70lbs. to 130lbs. per acre.

No definite information is available regarding the profitable amount to use, but the larger amount has no injurious effect upon the yields.

Four of the competitors did not treat their seed to prevent smut, and three of these crops showed traces of smut, illustrating the risk which is taken in planting untreated seed.

Mr. Lehman was the only competitor using the up-to-date dry method with carbonate of copper, and it is believed that the competitors who used the bluestone method of treatment reduced the yield, because of the lessened vigour which the seed has when so treated.

In one case where the seed was treated with bluestone, traces of smut were also found; this is believed to be due to the method and not to the inefficiency of the treatment.

It is pointed out that the dry treatment with carbonate of copper has been proved to be superior to the wet bluestone, and Mr. Lehman is to be congratulated on being the first of the competitors to use this method.

I would like to point out that Mr. Lehman was the winner of the competition last year and, I believe, suffered in yield owing to reduced rainfall which that part of the district had, 35 points only being registered for September.

In the majority of the competing crops traces of "take-all" were noticed. This points to the need of farmers in this district to pay attention to farming practices which will eradicate or at least control it.

Messrs. Hughes Bros. and Hewton—by obtaining first and second places in this competition—now represent this district in the Royal Crop Championship Competition in Zone 1.

DOWERIN AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixtur.	Evenness of growth.	Total.
	Points ...	35	25	15	15	10	100
Hughes Bros., Minnivale ...	Nabawa ...	35	23	14	14	9	95
Hewton, A. W., Minnivale ...	Nabawa ...	33	23	13	13	9	91
Lindsay, J., Wyalkatchem ...	Gluyas E. ...	31	22	14	14	9	90
Jones, A., Ejanding ...	Nabawa ...	34	21	13	13	9	90
Place, D., Dowerin	Federation ...	33	21	12	12	9	87
Jones, J. S., Ejanding ...	Nabawa ...	28	19	12	14	8	81
Leehman, C. E., Dukin ...	Gluyas E. ...	24	19*	13	14	7	77
Jones, H., Dowerin	Pennys ...	26	17	11	12	7	73

*Deductions—2 points third crop.

I. THOMAS, Judge.

BRUCE ROCK.

I have pleasure in submitting my report as Judge of the crops grown on the fallow connected with the above competition.

This competition, being the first of its kind in the State, one feels the Bruce Rock Agricultural Society by inaugurating same recognises that the time has arrived when a concerted effort should be made, by a practical demonstration, and information gained to prove that the pioneering stage is past and good farming must replace the rough and ready wheat growing methods if our average yields are to be increased, and therefore rise to that position we should attain amongst the wheat producing States of Australia.

It is by these competitions, where the farmer treates the 50 acres in competition somewhat more scientifically than he does his bulk areas, proof will be shown that 200 to 250 acres of wheat per team, sown on well-worked fallow—preferably after rain—is better than 500 acres scratched in on stubble or than 400 acres on rough fallow.

Having judged the fallow in March last, and a report published, I was indeed pleased to know that I had to adjudicate upon the crops grown thereon, so as to see if my comments on the various sections—such as moisture, irregular cultivation, cultivation after summer rains, and so on—were borne out by the crop. The irregularities could be traced in almost every entry.

The Season.—This was not a favourable one. The first good rains were late, not falling until the middle of May. This meant a large proportion of the district was sown dry without serious consideration as to whether the stubble or fallowed land was full of weed seeds ready to germinate with the wheat. The succeeding months were ones of anxiety to the farmer for, although the rain fell at fairly regular periods, the falls were not such as to give any surplus moisture in the soil should a dry period intervene towards the end of the season. This happened in September, and those crops which were not able to receive the benefit of a plentiful supply of soil-conserved moisture showed more disease, stunted growth, and grainless heads, due mainly to the lack of moisture necessary to the plant food in the development of the grain during the innoculation period. Those crops on the fallow which had received attention after the December and February rains appeared not to have suffered, but many of the others were only saved by the exceptionally favourable timely showers in October and lengthy cool ripening period.

Varieties.—It is pleasing to see that the varieties recommended by the Department occupy such a large acreage in this district, and the value of the stud seed is recognised as a means for obtaining an increased yield.

The varieties Nabawa, Gluyas Early, and Merredin held pride of place as midseason and early wheats, and farmers will do well to continue growing them until they are convinced that better varieties are available. Constant endeavour is being made to improve these standard varieties, but before sowing large areas of new and inconsistent old varieties, systematic trials on small areas with the above-named as a check or control are advisable.

The Awards.—The first prize, a Cup valued at £8 8s., is awarded to the competitor obtaining the highest aggregate number of points for 50 acres of fallow and crop grown thereon.

The coveted honour is gained by Mr. J. Lethlean, and Messrs. P. McCarthy & Son obtained second place with only one point less.

It is interesting to note that Mr. Lethlean's position after the judging of the fallow was second to Messrs. McCarthy & Son by two points. In the judging of the crop the former beats his opponent by three, and in the aggregate by one.

The variety chosen by Mr. Lethlean was Nabawa.

There was a striking illustration in this crop. Twenty acres were planted with stud seed before the rain. The stiff patches referred to in the fallow report—with large clods on the surface and insufficient fine soil beneath—could be picked out owing to irregular inconsistent germination, but on the 30 acres sown after rain, and the cultivator preceding the drill—these patches were hard to find, and the line showing the seeding before and after rain was plainly visible.

The weeds were few, mostly on the 20 acres dry sown.

It was a nice even crop, very few mixtures and absence of disease. The heads were well filled and practically no sign of the crop having suffered much during the dry period.

Sowing was started during the second week in May, when 20 acres were completed. Rain fell on the 12th (53 points), and on the 14th (140 points), delaying seeding until the 19th. Seed sown at the rate of 45 lbs. with super 90 lbs. per acre.

The rainfall from the commencement of fallow in June, 1923, to 30th April, 1924, totalled 1,319 points. During the growing period, 1st May to end of October, 1924; the total was 1,107 points.

Messrs. P. McCarthy & Son's crop of Nabawa from a casual glance on the outside appeared to be a very nice even one, very well grown, and well headed with plump grain, but on a systematic examination more weeds were encountered than in the leading crop; these consisted of thistles, mustard, and cockspur, with patches of take-all, which caused an unevenness of growth as shown by the allotted points.

This crop, as the fallow report shows, was grown on summer fallowed land and five crops had been taken off, but only twice fallowed, also butts of self-sown crop having been cultivated out and left lying on the surface. There is a possibility that the "take-all" was increased therefrom.

An interesting illustration was seen on this farm by summer fallowing with a mouldboard plough and a heavy "duckfoot" cultivator for the early germination of weeds. That portion worked with the cultivator showed earlier germination and thicker growth. Sheep would play a great part in keeping this early germination and thick growth of weeds in check, and when the summer fallow is winter ploughed early after seeding, the humus returned to the soil would be considerable.

Seed was sown with a Combine drill with light harrows attached, at the end of April, at the rate of 60 lbs., with 90 lbs. super. to the acre.

The rainfall from the commencement of the fallow in March, 1923, to 30th April, 1924, totalled 1,445 points. During the growing period, 1st May to 31st October, 1924, the total was 931 points.

A comparison of the rainfall received by the blocks entered by these first two competitors in this competition is worthy of attention.

Mr. Lethlean's block is situated close to Bruce Rock township, and Messrs. McCarthy & Son's seven miles West of that centre.

Messrs. B. Althom, with Merredin variety, and H. J. Yelland with Gluyas Early, tie for third place. Mr. Yelland lost his advantage of one point in

the fallow award by having a larger percentage of wild oats than Mr. Altham, otherwise the crops were very similar.

The details of award show the points allotted and indicate the position of the other competitors.

In conclusion, I must record the interest most settlers evinced by seeking information from the judge in connection with their farming operations irrespective of the block in competition, and their readiness to assist in his itinerary.

BRUCE ROCK DISTRICT AGRICULTURAL SOCIETY.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.	Total for Fallow.	Aggregate Total.
	Points ...	35	25	15	15	10	100	100	200
Lethlean, J., Bruce Rock	Nabawa ...	35	23	14	14	9	95	79	174
McCarthy, P. & Son, Eujinyn	Nabawa ...	35	22	13	14	8	92	81	173
Altham, E., Yalbarrin	Merredin ...	24	21	13	12	8	78	76	154
Yelland, J. H., Bruce Rock	Gluyas E. ...	24	20	13	12	8	77	77	154
Hedges, W. H., Koobberin	Nabawa ...	26	21	13	12	8	80	67	147
Farrell, F. C., Eujinyn	Nabawa ...	27	20	13	12	8	80	66	146
Brown, S., Bengullapin	Nabawa ...	27	20	13	12	8	80	63	143
Mullane, Ardath ...	Nabawa ...	24	20	13	12	7	76	63	139
Smith, C. & A. H., Yalbarrin	Nabawa ...	24	20	13	11	7	75	61	136
Iles, J. W.	Withdr'n ...	...	...	...	...	...	...	68	...
Brown, W.	Withdr'n ...	...	...	...	...	...	...	67	...
Smith, C. & Son ...	Withdr'n ...	...	...	...	...	...	...	66	...
Packard, J.	Withdr'n ...	...	...	...	...	...	...	64	...

H. RUDALL, Judge.

DALWALLINU.

This is the first competition connected with the above society. It was conducted under the same conditions as the other district societies' competition, except that the area was 25 instead of 50 acres, hence the first and second prize winners were debarred from automatically entering for the Royal Agricultural Society's Champion Prize in No. 1 Zone.

The competitors numbered 10. These were reduced to three by local judges, who prior to my visit had inspected all competing crops. The remaining competitors were: Mr. J. Harris, Dalwallinu; Mr. H. Richardson, Miling, *via* Pithara; and Messrs. Bradford Bros., of Ballidu.

In each case the land had originally carried gimlet and salmon gum timber.

The land had been fallowed in 1923, two competitors using the disc cultivating plough and the other, Messrs. Bradford Bros., preferring the heavy disc plough.

In each case the subsequent cultivations were the same, viz., after ploughing and prior to seeding, two competitors using the Springtyne cultivator, and Mr. Richardson the disc cultivator for the first cultivation.

The crops of Messrs. Bradford Bros. and Mr. J. Harris were sown in May, whereas Mr. Richardson sowed his early in April.

Rate of seed sown was from 50 to 60 lbs. and super. from 60 to 90 lbs. per acre.

In one case only was the seed treated for bunt, but in all entries it had been re-cleaned or graded. The weeds noticed were mustard and black oats, but these were not sufficient to have interfered with the growth of the crop. Mr. J. Harris' crop was particularly free from wild oats. A few odd heads of flying or loose smut were noticed in one of the crops. Although no smut was noticed in the crops, no farmer should conclude that it is unnecessary to treat the seed for this disease. The risk is too great.

Now the dry method has proved so effective, the inconvenience is nil when it is realised that the seed can be treated immediately after harvest or any time between then and seeding. The admixture in each entry were only a few stray heads of another variety. A little barley was also noticed. All care should be taken to keep the crops free from barley owing to the dockage made when placed on the market.

The first and third placed crops were very even in height and had stooled well, but in both cases a few tipped patches caused by ash-heaps were noticed. In the sowing of Mr. J. Harris' entry care was not taken to see that the drill lapped, as patches were noticed in places a foot wide where the drilling had been missed.

The germination in Mr. Richardson's entry appeared to have been somewhat irregular as some of the growth seemed to have got away early and made vigorous progress.

The feature outstanding throughout this competition was the regular germination, stooling, and evenness of growth shown by the May planting.

DALWALLINU AGRICULTURAL SOCIETY.

Competitors.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Bradford Bros.	Nabawa ...	32	20	14	12	9	88
Richardson, H.	Nabawa ...	32	20	13	12	8	86
Harris, J.	Gluyas, E. ...	26	17*	14	14	8	79

* Deduction, new land, 6 points.

I. THOMAS, Judge.

DOODLAKINE-BAANDEE DISTRICT.

Judging by the 16 entries which the secretary had secured, it was evident that he had succeeded in creating interest in the movement for increasing the prosperity of the district, and making it better known to the public.

Unfortunately seven of the competitors cancelled their entries. Two others were not judged in detail owing to the condition of the competing crops not reaching the standard set for these competitions.

The first place was gained by Messrs. Barton & Sons, who also were the winners last year. Mr. B. L. Murray was awarded second place with a crop giving the high yield of 36 bushels, or four bushels more than the winner; this crop failed to hold its advantage, however, mainly owing to

the presence of weeds which caused it to lose seven points. Both crops were planted on well-worked fallowed land and with somewhat similar treatment.

The winning crop was a late variety, Gluyas Late, planted in April, and the second was of Gluyas Early, planted a month later.

For comparison, the details regarding the treatment given these two and the other crops are set out in Table B (appended):—

TABLE B.—SHOWING METHODS OF CULTIVATION.

Particulars.	Barton & Sons.	H. Rawlings.	B. L. Murray.	J. W. Spillman.
No. of Crops ...	8th.	5th.	10th.	7th.
Timber ...	Gimlet and Salmon.	Gimlet and Salmon.	Gimlet and Salmon.	Gimlet and Salmon.
Ploughed ...	July.	June.	July.	July.
Depth	4 inch.	4 inch.	4½ inch.	4 inch.
Plough ...	Disc. Cultivator.	Mould-Board.	Mould-Board.	Disc.
Condition at Ploughing Time	Good.	Good.	Good.	On wet side.
Other Cultivation	Cultivated (Springtyne) Sept., Feb., and April, prior to seeding.	Skim ploughed in September, Cultivated prior to seeding.	Cultivated (skim-disc) in September, Cultivated (Springtyne) in October, and cultivator attached to drill.	Cultivated twice in August, early December and again in December after rain, also prior to seeding.
Variety	Late Gluyas.	Nabawa.	Gluyas Early.	Merredin.
Planted	2nd week April.	2nd week April.	Middle May.	1st week May.
Rate of Seed ...	57lbs.	50lbs.	60lbs.	60lbs.
Treated ...	Dry.	No.	Bluestone.	Bluestone.
Graded	Yes.	No.	No.	No.
Super	80lbs.	80lbs.	72lbs.	90lbs.

Particulars.	H. Reid.	McGregor Bros.	Prowse Bros.
No. of Crops ...	10th.	6th.	17th.
Timber ...	Gimlet and Salmon.	Gimlet and Salmon.	Gimlet and Salmon.
Ploughed ...	July–August.	July.	July.
Depth ...	4 inch.	4½inch.	4½inch.
Plough ...	Disc.	Mould-Board.	Mould-Board.
Condition at Ploughing Time	On wet side.	Good.	Good.
Other Cultivation	Cultivated after ploughing, skim ploughed prior to seeding.	Cultivated (Sundercut) in Sept. Cultivated, harrowed and rolled before drilling.	Cultivated twice in spring, and planted with Combine.
Variety	Late Gluyas.	Nabawa.	Nabawa.
Planted ...	End April.	1st week May.	Middle May.
Rate of Seed ...	45lbs.	60lbs.	45lbs.
Treated ...	Dry.	No.	No.
Graded ...	No.	Yes.	Re-cleaned.
Super ...	65lbs.	70lbs.	72lbs.

It will be noticed that the progressive farmers are agreed upon the necessity for ploughing in the winter and cultivating in the spring and just before seeding.

The rate of seeding varies from 45 to 60 lbs. per acre, and the time of sowing from the middle of April to middle of May.

The treatment of seed for smut is not general, though the majority have practised it; two of them adopting the up-to-date dry method.

In one instance when this method was adopted a little bunt was found. In view of the very satisfactory results obtained with this treatment, this is difficult to understand unless too small a quantity was used, or insufficient mixing.

Grading the seed—as in some other districts—is not as general as it should be.

Following up the usual practice, Messrs. Barton & Sons, and Mr. B. L. Murray, the winners of this competition, will represent this district in the Royal Agricultural Society's Championship Crop Competition in Zone 1.

DOODLAKINE-BAANDEE DISTRICT AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Barton & Sons, North Baandee	Gluyas L. ...	32	23	14	13	9	91
Murray, B. L., Doodlakine ...	Gluyas E. ...	35	18	13	12	8	86
Rawling, H., North Baandee	Nabawa ...	30	20	13	14	8	85
Reid, H., North Baandee ...	Gluyas L. ...	30	22	11	12	9	84
Spillman, J. W., Nth. Baandee	Merredin ...	30	20	13	12	9	84
Macgregor Bros., Doodlakine	Nabawa ...	28	18	13	12	8	79
Prowse Bros., Doodlakine ...	Nabawa ...	26	18	13	12	8	77

I. THOMAS, Judge.

KELLERBERRIN.

It was disappointing to find that in such an old and well-known district, which has always given a lead in progressive agricultural methods, so little interest was taken in this movement that there were only three competitors, namely, Messrs. Frank Mather, Jas. McLellan, and J. Deane Hammond. Two other entres were received but were cancelled before the date of inspection.

The winning crop of 50 acres was part of 280 acres, and was the eighth crop. It was sown on well prepared fallow which had been ploughed (mould-board) 4 inches deep during June, 1923. This land was cultivated with a Springtyne cultivator in August, September, and October of the same year, and again in April of the following year. It was sown with a combined cultivator drill late in May and early in June. The ground was harrowed after planting.

The second prize crop was also fallowed in June and July, 1923, and at this time the land was inclined to be boggy, and in consequence became hard and lumpy after ploughing. It was then broken down with a disc implement as the Springtyne cultivator was not suitable. In September this land was further cultivated with the Springtyne cultivator, and again prior to seeding, which took place in April, it was cultivated and rolled. This crop, unlike the winning crop, did not stand the checks which it received through the dry spells experienced during July and September. This is believed to be due to the want of "heart," owing to the ploughing which took place whilst the ground was boggy. On both crops 60 lbs. of graded seed per acre had been sown, with an application of superphosphate at the rate of 90 lbs.

and 80 lbs. respectively. That of Mr. J. D. Hammond was treated with carbonate of copper, whilst the other was not treated. Owing to the absence of Mr. Mather, no particulars regarding the cultivation for this crop could be obtained.

The winning crop was very even, whilst the other two were irregular; and, in the case of Mr. Mather, strips had been missed when drilling. There were also a few strips of another variety sown, which considerably reduced the points given for freedom from admixture.

During July and September, very dry spells were experienced, yet despite these the very satisfactory yield of 34 bushels was obtained, and this is evidently due to and a triumph for correct and thorough methods of cultivation.

KELLERBERRIN AGRICULTURAL SOCIETY—1924.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Points ...	35	25	15	15	10	100
Hammond, J. D., Kellerberrin	Nabawa ...	34	23	13	14	9	93
McLellan, J., Mt. Stirling ...	Nabawa ...	24	20	13	12	8	77
Maher, F., Kellerberrin ...	Nabawa ...	27	22	12	6	8	75

I. THOMAS, Judge.

ROYAL AGRICULTURAL SOCIETY.

Name and Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
*McLean, J., County Peak, Beverley	Nabawa ...	35	20	13	14	8	90
†Hebiton, J. K., Three Springs	Gresley ...	31	23	13	12	9	88
†Carter & Son, Three Springs	Niloc ...	35	20	11	11	8	85
†Lukin, G., Calcarra	Major ...	34	18*	12	12	9	85
†Vanzetti, Mrs., Marchagee ...	Nabawa ...	23	21	13	13	6	76
*Locke, J. H., Pithara ...	Nabawa ...	21	17	13	13	7	71

* Deductions: 2 points third crop.

*I. THOMAS.

†W. P. CASS-SMITH, B.Sc., Agric.

NUNGARIN AGRICULTURAL SOCIETY.

Four crops were entered in this competition; they were all good, with very little difference between them.

The first was of "Gluyas Early," belonging to Mr. Creagh. It was very even in growth and very free from weeds and admixture, an odd plant of barley being the only thing that detracted from its appearance. This was sown the first week in May, 40 lbs. seed and 70 lbs. super. being used.

The second crop was also "Gluyas Early," belonging to Mr. F. Warner, and was similar in many respects to Mr. Creagh's crop. It contained some mustard and wild oats, but was very free from admixture. It had gone down rather badly in some places, which detracted somewhat from its appearance. This crop was sown the third week in April with 48 lbs. seed and 75 lbs. super.

The third crop was "Nabawa," belonging to Mr. Johnson. It was sown in early May with 55 lbs. seed and 60 lbs. super. This contained some mustard and some undergrowth, and was rather uneven owing to some rocks and a watercourse, but it was very free from admixture and disease.

The next crop was "Gresley," belonging to Mr. Stagg. This was rather uneven in growth and contained a fair percentage of ball smut, also a few plants of flying smut and an odd plant of flag smut. There were a few weeds in places.

Details of the awards are shown in attached table:—

CROP COMPETITION.

NUNGARIN DISTRICT AGRICULTURAL SOCIETY.

Competitor.	Address.	Variety.	Yield.	Freedom from weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of growth.	Total.
		Possible Points	35	25	15	15	10	100
Creagh Bros. ...	Nungarin ...	Gluyas Early	29	22	14	13	9	87
Warner, F. ...	Nungarin ...	Gluyas Early	28	20	14	13	8	83
Johnson, Mr. ...	Nungarin ...	Nabawa ...	28	21	14	13	6	82
Stagg, Mr. ...	Nungarin ...	Gresley ...	24	21	11	12	6	74

Judge: J. LANGFIELD.

MERREDIN AGRICULTURAL SOCIETY, 1924.

This year there were 13 competitors for this competition, the first and second being eligible for the Royal Agricultural Society's Cropping Competition.

The winning crop was that of Mr. G. Woolgar, of Goomarin, and the variety was "Nabawa." This was seeded at the rate of 42 lbs. per acre with 100 lbs. of super., and was sown the second week in May. It was very well developed, being on Jam and Salmon Gum country, which holds the moisture better than the Gimlet country. It was fairly even but contained a small percentage of wild oats, but not sufficient to in any way interfere with the yield.

The second crop was Messrs. Teasdale Bros., of "Cumberland Farm," Belka, and the variety was "Merredin." This was an even and well-grown crop, but it contained a few small patches of "Take-all"; the paddock also contained a couple of depressions, and the crop was somewhat lighter in these. There was a trace of Flag Smut in places, but this was on the flag only and the plant was not injured. In the low places there were also a few blighted ears.

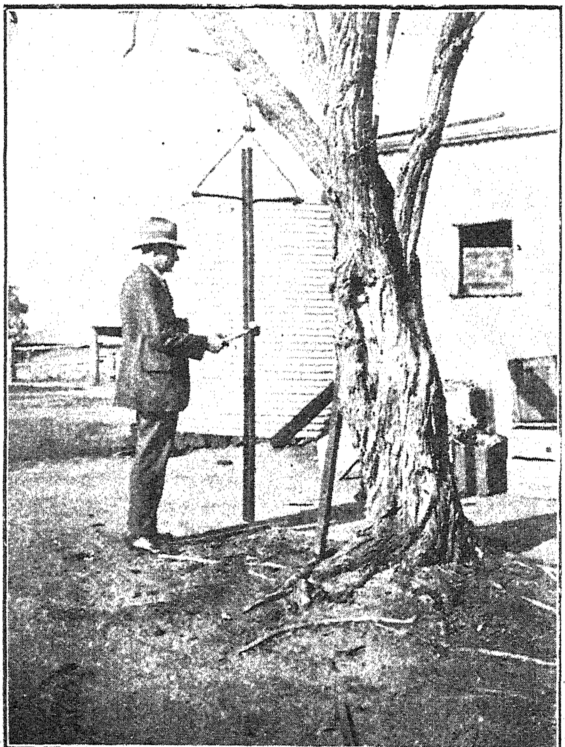
Points were awarded as shown in the table hereunder:—

CROP COMPETITION.

MERREDIN DISTRICT AGRICULTURAL SOCIETY.

Competitor.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Total.
	Possible Points ...	35	25	15	15	10	100
Woolgar, W. G.	Nabawa	35	22	13	14	8	92
Teasdale Bros. ...	Merredin	35	23	12	13	8	91
Dumsday, G. ...	Nabawa	34	23	14	11	8	90
Harling Bros. ...	Nabawa	32	22	13	14	8	89
Wagner, C. ...	Gresley	34	22	11	12	8	87
Pollock, R. ...	Gluyas Early ...	34	19	11	14	9	87
Walker, H. ...	Gluyas Early ...	32	21	12	14	7	86
Teasdale, H. W.	Newman's Early ...	31	20	13	12	8	84
Priestley, J. P. ...	Nabawa	28	21	13	13	8	83
McConnell, E. J.	Nabawa	27	23	9	13	7	79
Clothier, J. ...	Metredin	25	21	13	13	7	79
Kay, J.	Nabawa	26	20	12	13	8	79
Brown, C. L. ...	Nabawa	26	22	13	11	7	79

JUDGE—MR. J. LANGFIELD.



CEREAL SMUTS.

(Continued from page 19.)

W. M. CARNE, F.L.S.,
Botanist and Plant Pathologist.

OAT SMUTS.

(*Ustilago levis* and *Ustilago avenae.*)

Two smut diseases of oats occur in this State as in other oat-growing countries. Though caused by distinct fungi, the resemblance between the two is so close that they may be and are regarded by the farmer as one. The distinctions, even under miscroscopic examination, are not always readily seen, and even scientific workers have confused them. There are, however, certain field differences which in most cases leave little doubt as to which of the parasitic fungi are responsible in each case. With *Ustilago avenae* or *loose smut* more or less of the chaff as well as the grains are converted into the powdery black smut, which is finally blown away leaving only the bare branches of the head. With *Ustilago levis* or *covered smut* the chaff is little or not affected, and the smut masses do not so readily break up and blow away. Covered smut appears to be the more common in this State.

Symptoms.—As already stated the grains, and in loose smut the surrounding chaff, are converted into black powdery masses. (Fig. 1.) Smut develops early in the formation of the heads and may be noted even before they get free from the boots or enveloping leafsheaths. Usually all the grains on a head are infected, but occasionally the smut is confined to the lower, the upper grains developing normally. By harvest time (for grain) the bulk of the smut has been blown away, leaving only bare stalks and the remains of the chaffy grain coverings.

Loss due to Smut.—As compared with bunt or ball smut of wheat, oat smut is a much less serious disease. At the same time losses are frequently much more important than is realised, as an estimate of the percentage of infection can only be reliably made at flowering time. At harvest many of the smutted plants may be overlooked owing to the smut having blown away. The disease is commonly present in all oat crops, but the infection probably does not exceed 5 per cent. in the majority of cases. Losses, however, up to 25 per cent. or more may occur. The importance of the disease lies in the direct loss of grain. The sound grain harvested is not deteriorated commercially. There is no objectionable odour or visible evidence of the presence of smut. A minor loss from the point of view of hay may result from the fact that smutted plants tend to head early and to be somewhat shorter than sound plants. There is also a loss of food value through the destruction of the grain.

Life History.—As in bunt or ball smut of wheat, the smut consists of spores (chlamydospores) or fungoid seed bodies. Infection also takes place only in the early seedling stage up to the appearance of the first green leaf. Exactly how it is brought about is somewhat uncertain. To some extent it may be from spores on the outside of the grains, but it is more likely that the greater amount is due to spores which are blown at flowering time into open flowers of the normal plants. These spores are caught inside the hulls, and with the growth of the grain and the adherence to it of the hulls are firmly enclosed. When the grain is sown the spores germinate, producing germ tubes which enter the young seedling and develop into the parasitic stage of the fungus. As the plant grows the fungus grows with it, and finally, when the flowers are formed, enters them and converts them into smut masses.

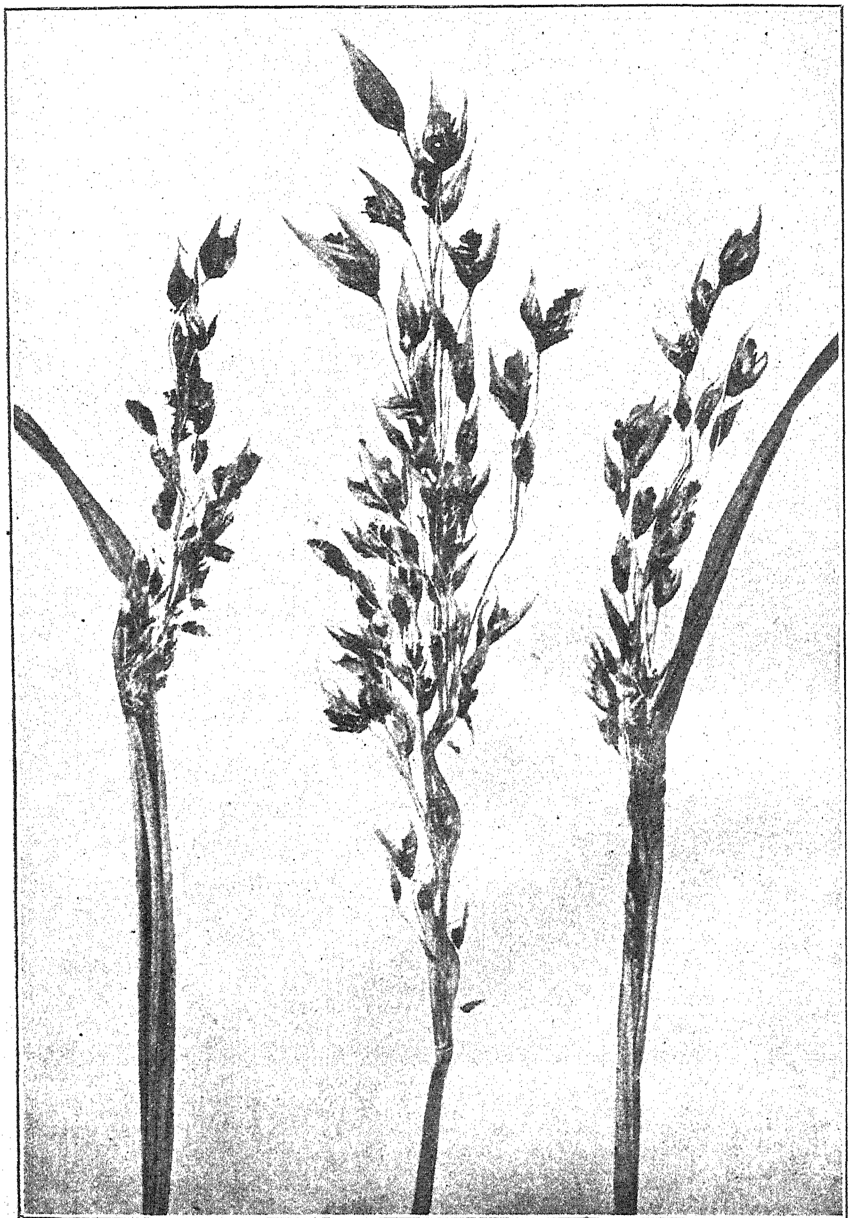


Fig. 1. Smut of Oats.
(After McAlpine.)

In experiments dusting the grains of ordinary hulled oats does not give the infection secured with similar treatment of wheat with bunt spores. With skinless oats, or oats which have been artificially dehulled, infection takes place readily.

Treatment.—Clean crops will produce clean seed. Such crops are, however, rare. It is advisable to regard all oats as more or less smutted. Infection taking place from spores on or caught within the hulls of the grain, it is possible by seed treatment to prevent these spores bringing about infection. In general, farmers take no precautions but put up with an avoidable loss. Formalin is recommended for seed treatment, but where a farmer is using copper carbonate for wheat he will probably prefer to use it for oats also. The dry treatment is not as effective as formalin, probably owing to it being less able to penetrate the hulls. However, experimental results indicate that it gives a reasonable control and considerably reduces the percentage of smut. At the same time it is free from the objectionable action of formalin on germination, and may be used on the seed long before sowing.

For those who prefer formalin there are several methods of using it. The following is advised in preference to dipping in a solution, as the grain is more readily dried sufficiently to run through the drill:—

Place the grain in a heap on a tarpaulin or clean flour. Sprinkle with a formalin solution, made by adding one pint of formalin to about 35 gallons of water, using about one gallon to a bushel of grain. The solution may be sprinkled from an ordinary watering can. As it is applied the grain should be shovelled from one heap to another until all is wetted. When finished, cover the grain with bags wetted with the formalin solution for six to eight hours. Then spread the grain out to dry. Sowing should take place soon after the treatment of the grain before it becomes quite dry, or the germination may be detrimentally affected.

If the dry treatment is adopted, two to three ounces of copper carbonate should be used to the bushel, taking care that the seed is thoroughly dusted.

COVERED SMUT OF BARLEY.

(*Ustilago hordei.*)

Covered smut of barley is not uncommon in Western Australia, but rarely occurs in sufficient quantity to receive any attention from farmers, as barley is not one of our important grain crops. It is frequently confused with Loose Smut. Covered smut may be recognised by the black smutty spore masses, which persist until harvest. The whole of the affected heads are involved, the grains and their coverings being replaced by the mass of dark purplish black spores at first covered by a thin membrane. (Fig. 2.) Some of the smut masses may be blown away, but usually a number persist and are harvested with the grain.

The life history appears to be similar to that of oat smut, infection taking place on the young seedling, but unfortunately the fungus does not respond so readily to seed treatment.

Formalin has been generally recommended but does not give absolute control, and its good effects are somewhat negatived by its detrimental action on the seed. Copper carbonate has not proved to be effective to any extent. At present, unless smut is very bad, seed treatment with these preparations is not advised. In Europe and North America wet treatments with organic mercury compounds such as Chlorophol and Semesan are giving promising

Fig. 2. Covered Smut of Barley.
(After McAlpine.)

results in experiments, but these compounds are not available to farmers here. The use of grain from affected crops should be avoided if possible. This applies also to barley threshed too closely so that portions of the seed coverings are torn away. Such seed is very liable to smut infection and bad germination. Clean crops will give clean seed, but such crops are rare.

Fig. 3. Loose Smut of Wheat.

LOOSE OR FLYING SMUT OF WHEAT.

(*Ustilago tritici.*)

Loose smut is common in our wheat areas. The whole of an affected head, both grain and chaff, is converted into a loose black mass of dusty spores at about the time healthy wheat is flowering. (Fig. 3.) By harvest the smutty

spores have been blown away, leaving only bare stalks. In consequence the amount of loss is often overlooked or assumed to be much less than in reality.

Loss.—The loss of grain is the only important effect of this disease. There is no objectionable odour as with bunt, and consequently the commercial value of the grain crop harvested is not affected. The disease does not spread as rapidly as bunt, and is of much less importance economically. Nevertheless the losses are at times considerable.

Life History.—Unlike bunt and oat smuts, infection takes place at flowering time. The loose dusty smut spores (chlamydospores) are blown into the open flowers of the healthy wheat plants from those which are smutted. The spores fall upon the stigmas or sensitive portions of the embryo grains and germinate there. The spore tubes produced by them enter the young grains. These latter develop to all appearances quite normally. If planted the following season, however, the fungus which has lain dormant within them commences to grown again, and enters the young shoot, growing with it until it heads. It then enters the head and converts the grain and chaff into the mass of spores we know as smut.

Prevention.—As the fungus is within the seed it follows that the use of bluestone, formalin or copper carbonate cannot be effective. These preparations can only be used to kill smut fungi before they infest the seed. Once the seed is infested internally they are useless.

The treatment most readily available to the farmer is one of prevention. Crops free from smut and reasonably far enough from affected crops will produce clean seed. Freedom from smut can, however, only be told by examination at flowering time.

If a small seed plot is raised and all affected plants removed as soon as the smutted heads show, the grain produced will be clean. This involves regular and close work which is out of the question for most farmers. However, if seed is purchased from the State Experiment Farms the resulting crops will be found free from smut, as the system adopted at those institutions is such as to ensure clean crops.

One direct method of seed treatment is available where smut is bad, but is not advised for general use owing to the difficulties of its application. It is known as the modified Jensen hot water treatment, and is quite extensively used in the United States of America. Only sufficient grain for seed plots is treated, and the resultant crops are used for the main crops of the following year. The treatment consists of soaking the grain for 5-7 hours in water at ordinary temperatures, and then hot water for ten minutes. The hot water should be about 129° F. and must not fall below 124° or exceed 131° or the treatment will be ineffective or the grain badly affected. Fuller details may be had on application to this Department.

LOOSE SMUT OF BARLEY.

(*Ustilago nuda.*)

This disease occurs to a small extent in most barley crops, but as a rule receives little attention from farmers. As with covered smut, the affected heads are converted into masses of spores. It differs, however, in that the spores (smut) are dark brown, the spore masses break up about flowering time, and by harvest are all blown away, leaving only the bare stems.

It has long been believed that this smut affected the grain at flowering time in the same way as loose smut of wheat, and was so stated in the intro-

Fig. 4. Loose Smut of Barley.
(After McAlpine.)

duction to this article. Quite recently it has been found that a good deal if not all of the infection takes place on the seedling as in covered smut of barley, oat smut, and bunt of wheat.

Formalin, as recommended for oat smuts, gives a certain amount of control. Copper carbonate appears to be quite ineffective. Better results have been obtained in experiments in the United States of America with the organic mercury compounds mentioned under covered smut. At present seed treatment cannot be recommended except when smut is very bad, in which case formalin is advised. The use of grain from affected crops is not advisable if it can be avoided. Clean crops will give smut-free seed, but such crops are rare. Freedom from smut can only be determined at flowering time. It is too late at harvest time. Grain too closely threshed so that portion of the seed coverings are torn away should be avoided, as such seed is very liable to smut infection and bad germination.

SUMMARY.

The following are the smut diseases of cereals known to occur in this State, and the methods advised to control them:—

Flag Smut of Wheat.—Treat seed with copper carbonate as a precaution against infecting clean paddocks. Rotate with fallow, oats, or other crops. Use Nabawa when sowing wheat in a paddock previously affected.

Bunt or Ball Smut of Wheat.—Treat seed with copper carbonate dust unless it is known to come from clean crops.

Loose Smut of Wheat.—Use seed from clean crops. Seed from the State Experiment Farms is clean.

Loose and Covered Smuts of Oats.—Treat seed with formalin or copper carbonate (the former is preferred) unless it is known to come from clean crops.

Loose and Covered Smuts of Barley.—No treatment is advised unless smut is very bad, in which case formalin should be used. Clean crops will give clean seed.

FERTILISER EXPERIMENTS WITH POTATOES.

Farmers' Trials at Benger, 1925.

G. N. LOWE,

Senior Potato Inspector.

The fertiliser generally used for potatoes in the Benger swamp area has been superphosphate (18 per cent.) applied at the rate of 15 to 20 cwt. per acre. Recently some growers have, as the result of experience, decided that superphosphate alone is unsatisfactory, and that for best results it is necessary to add some form of nitrogenous fertiliser to the superphosphate. In consequence a potato manure containing 3.02 per cent. of nitrogen and 13 per cent. soluble phosphoric acid is being tried. There is some justification for this belief for the soil of the Benger swamp is covered with water, which starts to recede in spring, and becomes dry in January when the potato crop requires to be planted. Because the soil is under water throughout the winter, and there is a very limited time in which to prepare and till the soil before planting, the quantity of available nitrogen is likely to be limited, and therefore the application of a nitrogenous fertiliser appears to be justified.

The soil of the Benger swamp is a free working blue clay, physically well adapted for the cultivation of potatoes, and possibly, like other clays, contains sufficient potash for the immediate requirements of the crop. In planning the experiment it was, however, decided to obtain some information on this point. Most of our soils are regarded as deficient in phosphoric acid, and it is probable that the Benger soils in common with others are also deficient, but, despite this assumption, it is believed that the quantity of phosphoric acid supplied in the usual dressings of the two fertilisers referred to is altogether out of proportion to the needs of the soil or the crop.

With the kindly co-operation of Mr. C. L. Clarke, of Burekup and Benger, it was decided to carry out an experiment in the midst of his main potato crop in order to determine the composition of a well-balanced fertiliser best adapted for application to the potato in these soils. The plan adopted in this experiment has been to apply a complete fertiliser to a number of control plots, used as the basis of comparison, and then to ascertain—

(a) The effect of the absence of potash;

(b) The effect of reducing the quantity of nitrogen applied;

(c) The effect of reducing the quantity of soluble phosphoric acid;

(d) The effect of using nitrate of soda instead of sulphate of ammonia as a source of nitrogen.

It was intended also to use blood in this connection, but it was not procurable. In view of the past experience of the growers it was assumed that

both phosphoric acid and nitrogen were necessary constituents of any fertiliser for these soils.

As a matter of special interest to the Benger growers it was decided to include in the experiment a plot fertilised with the potato manure referred to, and with which other fertilisers could be compared. With this object in view the check or control plots were fertilised with a complete fertiliser which, in addition to potash, contained the same quantities of nitrogen and phosphoric acid as would be found in a liberal dressing of "Potato Manure." Each of the three different ingredients of plant food applied to the control plots was on a liberal scale. This was to ensure that the yield consequent upon a variation of the quantity of one of the ingredients would not be influenced by a deficiency of any of the other two.

The quantity of plant food applied to each plot, the fertiliser used to provide that plant food, and the order in which the plots were planted, may be seen from the following particulars:—

FERTILIZER EXPERIMENTS WITH POTATOES.

BENGER, 1925 (SUMMER CROP.)

Plot No.	Plant Food supplied per Acre.	lbs.	Fertilizer used.	lbs.
Plot 1 Control.	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 2	Nitrogen	70	Potato Manure	2,320
	Phosphoric Acid	300		
Plot 3	Nitrogen	70	Sulphate of Ammonia ...	350
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 4	Nitrogen	40	Sulphate of Ammonia ...	200
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 5 Control	Nitrogen	100	Sulphate of Ammonia	500
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 6	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	200	Super	950
	Potash	100	Sulphate of Potash ...	204
Plot 7	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	100	Super	475
	Potash	100	Sulphate of Potash ...	204
Plot 8	Nitrogen	100	Sodium Nitrate	645
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204
Plot 9 Control	Nitrogen	100	Sulphate of Ammonia ...	500
	Phosphoric Acid	300	Super	1,430
	Potash	100	Sulphate of Potash ...	204

Because of the liberal application necessarily given to the control plots, and of the plant food applied to some of the plots solely to enable comparisons to be made, it is not practicable to draw conclusions as to the commercial value of the different mixtures used in this experiment. The benefits derived from it are due to the comparisons which can be obtained from the yields due to the different treatment given to the plots. In this connection it will be seen from the particulars given that the only difference between Plots 2 and 3 is that the second plot has received no potash; that Plots 3 and 4 have had applied to them respectively two-thirds and one-third the amount of nitrogen given to the control; that Plots 6 and 7 similarly have had respectively two-thirds and one-third the amount of phosphoric acid, and that Plot 8 has received the same amount of complete plant food as the control, but the nitrogen has been supplied by the quicker-acting nitrate of soda. From the differences thus stated the comparisons can be made.

The experiment was placed in the centre of the paddock in which the main crop was planted. The preparation of the soil and other cultural operations were therefore the same as those given to the main crop. Each plot consisted of one row ten chains long, and which extended almost across the paddock. The planting was done on 4th February, the variety was "Delaware"; whole sets were used, and were dropped at the rate of about 1,500 lbs. per acre.

The condition of the soil at planting time was ideal, and it is doubted if Benger swamp has ever, as a whole, been in better condition at this period. Unfortunately the season, from the standpoint of heavy yields, was most unfavourable, as practically no rains of value fell between planting and harvest time. The rainfall recorded at the nearest station, Brunswick, during the growing period was February 4, March 67, and April 50 points. Further, owing to dry weather, an outbreak of green aphis occurred just when the crop looked a veritable picture, and in consequence a most promising crop was reduced to about a third of the yield which might have been reasonally expected had the usual rains fallen, for this would have checked the aphis.

When planning the experiment it was anticipated that the main crop surrounding the experiment would be manured with "Potato Manure." It was, however, manured with superphosphate at the rate of 1,800 lbs. per acre. It was decided to take advantage of this alteration of plans, and to harvest for purposes of comparison two rows, one on each side of the experiment block. These two rows are indicated in the table of results by the letters "A" and "B." They were fertilised with superphosphate at the rate of 1,800 lbs. per acre, but in every other respect were treated identically with the experimental rows.

The plots were harvested on 6th and 7th May. For the purpose of ascertaining whether the yield from each row was consistent or not, each row was divided into four equal sections two and a-half chains long, and each section was harvested and weighed up separately. From the yields obtained from the different sections it will be noticed that the yield receded in each section consistently toward the fourth. This may be accounted for by the fact that the soil was not so moist toward the fourth section, or north end of the plot. The yields obtained are set out hereunder:—

FARMERS' TRIALS.

FERTILIZER EXPERIMENTS WITH POTATOES.

BENGER, 1925.

Variety—Delaware. Planted 4th Feb., 1925. Harvested 6th and 7th May, 1925. Seed per acre 1,500lbs.

Plot.	Fertilizer per Acre.	Yield. 1st. Section 1/100th of an acre.	Yield. 2nd. Section 1/100th of an acre.	Yield. 3rd. Section 1/100th of an acre.	Yield. 4th. Section 1/100th of an acre.	Average.	Per-cent-age Yield.
		T. C. Q. L.	T. C. Q. L.	T. C. Q. L.	T. C. Q. L.	T. C. Q. L.	
A.	1,800lbs. Superphosphate	3 17 2 20	3 16 3 4	2 17 0 16	2 10 0 0	3 5 1 17	89
	Control.						
1	500lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sulphate Potash	3 15 3 16	4 0 1 12	4 1 1 0	3 0 2 24	3 14 2 6	100
2	2,400lbs. Potato Manure	4 3 0 4	3 15 3 16	3 11 1 20	3 0 2 24	3 12 3 2	97
3	350lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	3 14 0 12	3 6 0 8	4 2 0 16	3 6 0 8	3 12 0 11	95
4	200lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	3 16 3 4	4 3 0 4	3 18 2 8	3 6 0 8	3 16 0 13	100
	Control.						
5	500lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	4 11 3 24	4 5 2 24	3 11 1 20	2 18 0 4	3 16 3 4	100
6	500lbs. Sul. Ammonia 950lbs. Super. ... 204lbs. Sul. Potash	4 5 2 24	4 7 2 0	3 15 0 0	3 2 2 0	3 17 2 20	104
7	500lbs. Sul. Ammonia 475lbs. Super. ... 204lbs. Sul. Potash	4 3 3 20	4 3 0 4	3 11 1 20	2 13 2 8	3 13 3 27	100
8	645lbs. Sodium Nitrate 1,430lbs. Super. ... 204lbs. Sul. Potash	4 12 3 12	4 9 1 4	3 15 3 16	3 2 2 0	4 0 0 15	112
	Control.						
9	500lbs. Sul. Ammonia 1,430lbs. Super. ... 204lbs. Sul. Potash	4 0 1 12	3 15 0 0	3 8 3 0	2 15 1 12	3 9 3 13	100
B.	1,800lbs super.	3 6 0 8	2 15 1 12	3 6 3 24	2 13 2 8	3 0 1 27	89

Because of the liberal rate at which the plots were fertilised to facilitate comparisons of yields, it is not practicable to make comparisons of the relative money values of the different fertilisers applied to the respective plots nor can definite conclusions regarding the causes which have influenced the yields be drawn from the results obtained, as the experiment has been conducted for one year only, and this has been an unusually dry one. Interesting comparisons can, however, be made and tentative inferences drawn from them.

On examining the percentage results which are the most suitable for comparisons, it is found that the difference between the results from the plots with and without potash is so slight as to indicate that potash is not a necessary constituent of a fertiliser in order to secure a crop like that obtained on this occasion. The results obtained from the plots receiving the varying amounts of soluble phosphoric acid are also so similar as to indicate that the maximum amount applied on this occasion is much in excess of requirements, and that the usual application of 15 cwt. of superphosphate per acre is wasteful.

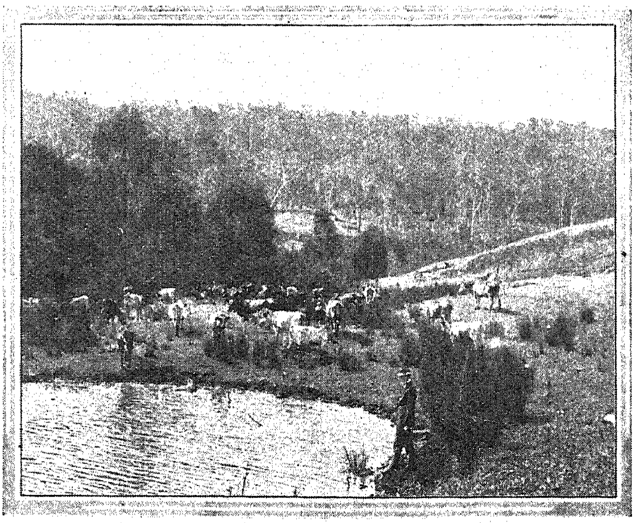
It would also appear from a comparison of the yields of Plots 3 and 4 with those of the control plots that, in a dry season like the past, the lighter dressings of sulphate of ammonia are as effective as the heavier ones, but the differences between the return from the plots which have received a nitro-

genous dressing are so consistently greater than those from the Plots A and B, which received no nitrogen, and which also received no potash, but which is apparently not needed, that they strongly support the view that nitrogenous fertilisers are necessary for best results on these soils.

Additional support in this direction is afforded by the increase of 12 per cent. resulting from the use of the quick-acting nitrate of soda, when applied instead of the slower-acting sulphate of ammonia.

The most striking feature of this experiment is the apparent indication of the scarcity of available nitrogen in this soil. This is not very surprising, seeing that it is submerged six months of the year, and that in consequence, nitrification can be active only for a limited period. Under such circumstances the obvious lesson is, that to economise in the purchase of expensive fertilisers, it is essential to commence the preparation of the soil at the earliest date possible, and further to give the crop the maximum amount of inter-tillage so as to stimulate the process of nitrification to the fullest extent.

That such a practice would be beneficial is rather supported by the experience of two growers, Messrs. Gibbs Brothers, who latterly have made a practice of fallowing at least a portion of their block immediately after the planting period has ended in January, and leaving it unplanted until the next season. Although this fallowed land is submerged during the following winter, it has been found that the growth of the crop is so improved that the position of the fallowed portion can be determined to the row by the appearance of the crop.



DAIRY HERD IMPROVEMENT.

P. G. HAMPSHIRE,
Dairy Expert.

Following upon the Department's policy of urging the use of registered pure sires ex dams with official butter fat production of such merit as will enable the progeny of these cows to be the means of improving the progeny of the average production cows of the State, the following is a list of all standard cows which have been officially tested to date. When the scheme for dividing the State into zones for the use of registered pure bulls ex these proved production cows was launched, it was noted the success of such a scheme would depend upon continuity of policy, and following on the use of the male progeny of standard cows it is confidently expected that material advance will be made in the production of the average cow in each of the zones through their progeny.

The Government has laid down that the only bulls that will be purchased for distribution to group settlers and others must be the progeny of cows with a production record above the standard decided upon. The information shown in this and the last issue of the *Journal* gives the name of owner, name of cow, breed, herd book number, weight of milk for period, average test, total butter-fat and standard required—lbs. of fat. In confirmation of circular issued on 29th May, 1924, the standard of production over a period of 273 days' test is 166 lbs. fat (or 200 lbs. commercial butter) in the case of a heifer on first calf, 207 lbs. fat (or 250 lbs. commercial butter) in the case of a cow under four years, and 249 lbs. fat (or 300 lbs. commercial butter) in the case of a mature cow.

Concluded list of registered pure cows which have been officially tested and exceed the required production, enabling their male progeny to be eligible for purchase by the Government with a view of improving the dairy herds of Western Australia.

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Carnation of Dardanup... ...	R. H. Rose ...	Jersey	9995	10,788	5·57	600·99	249
Mokine Lady Guildford III. ...	T. H. Wilding	do. ...	10634	9,265	6·25	579·23	
Yarraview Bonnie Annie ...	A. W. Padbury	Guernsey	564	8,127	6·11	496·63	
Lily II. of Dardanup	R. H. Rose ...	Jersey ...	8946	9,345	5·24	489·90	
Jessie of Dardanup	do. ...	do. ...	8945	9,320	5·14	479·25	
Retford Buttercup II.	D. J. Goyder...	do. ...	6830	6,535	6·87	449·52	
Daisy of Grass Vale	R. H. Rose ...	do. ...	8473	7,615	5·56	423·83	
Fancy of Ventonia	T. L. Rose ...	do. ...	8648	7,782	5·35	416·78	
Mokine Dianthus	Walker & Co.	do. ...	8483	7,153	5·73	410·34	
Beauty 3rds Wangara of Pine Hill	R. H. Rose ...	do. ...	6134	9,214	4·44	409·54	
Veronica of Tarnpirr	D. J. Goyder ...	do. ...	5174	8,121	4·87	395·70	
Madge of Dalebank	D. Malcolm ...	do. ...	4759	6,985	5·59	390·44	
Lily II. of Dardanup	R. H. Rose ...	do. ...	8946	7,933	4·92	390·16	
Fancy of Liryclea	A. H. Henning	do. ...	6674	7,582	5·10	387·19	
Romany Maid of Tarnpirr ...	P. Rose ...	do. ...	6036	6,823	5·66	386·24	
Silver Bell of Roelands ...	A. H. Henning	do. ...	10047	7,911	4·82	386·01	
Obligato	D. J. Goyder...	do. ...	4964	7,641	4·99	381·58	
Retford Violet	W. Padbury ...	do. ...	6938	6,528	5·78	378·08	
Rhodesia of Ventonia	T. L. Rose ...	do. ...	8469	6,884	5·33	366·86	
Lady of Inglewood	D. Malcolm ...	do. ...	5910	6,111	5·89	360·11	
Fondant 9th of Barden Hill ...	W. Padbury ...	do. ...	8456	6,801	5·23	355·84	
Mokine Columbine	T. H. Wilding...	do. ...	10043	5,881	5·94	349·85	
Rhodesia 5th of Penryn ...	T. L. Rose ...	do. ...	8470	7,272	4·77	347·35	
Lux of Yarralla	D. J. Goyder	do. ...	6825	7,143	4·66	333·50	
Lady Betty II. of Koogan ...	A. W. Padbury	Guernsey	872	7,685	4·33	332·99	
Lady of Inglewood	D. Malcolm ...	Jersey	5910	5,898	5·62	331·46	
Creamy of Dardanup	R. H. Rose ...	do. ...	8941	6,197	4·99	309·44	
Yarraview Isabel	A. W. Padbury	Guernsey	397	6,238	4·77	297·86	

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Lady Fowler II. of Dardanup...	R. H. Rose ...	Jersey ...	10003	6,252	4·65	290·63	
Antimony's Elvira	T. L. Rose ...	do. ...	8465	5,142	5·61	288·67	
Mokine Picotee	Walker & Co.	do. ...	8486	5,135	5·61	288·55	
Jessiemia XI. of King's Vale ...	D. Malcolm ...	do. ...	6339	6,510	4·36	284·14	
Purity of Gowrie Park ...	W. G. Burgess	Ayrshire	4915	6,463	4·25	274·95	
Golden Gem of Dardanup ...	D. J. Goyder ...	Jersey ...	9988	6,120	4·39	267·94	
Belverdere 5th of Dardanup ...	P. Rose ...	do.	8925	5,797	4·59	266·31	
Lady Fowler 9th of Dardanup ...	T. L. Rose ...	do. ...	10008	9,838	4·98	489·95	
Flavoria of Banyule	Dept. of Agriculture	do. ...	8489	7,908	5·92	468·55	249
Girlie of Sarnia	D. Malcolm ...	do. ...	9992	9,180	4·85	446·01	
Lydia 5th of Yarralla	D. J. Goyder...	do. ...	6826	7,044	5·08	357·77	
Milton's Rosebud	A. W. Padbury	Guernsey	500	7,255	4·72	342·89	
Ice Cream of Glen Iris ...	W. Padbury ...	Jersey ...	7110	5,978	5·00	299·32	
Mokine Woodbine	T. H. Wilding	do. ...	8487	6,277	5·95	373·76	
Twylish Madeira of Roelands ...	D. Malcolm ...	do. ...	6832	5,356	5·77	309·08	
Tipperary Winsome	W. G. Burgess	Ayrshire	6166	6,441	4·67	301·42	
Boronia of Grass Vale	R. H. Rose ...	Jersey ...	9994	8,091	5·06	410·11	
Mokine Lady Noble	Walker & Co.	do. ...	10633	6,190	5·88	364·27	
Mokine Fancy	T. H. Wilding	do. ...	8484	5,337	5·99	319·13	
Yarraview Georgina	A. W. Padbury	Guernsey	782	5,763	5·24	297·04	
Rena II. of Gleneira	W. G. Burges	Ayrshire	8519	5,653	5·09	288·13	207
Mokine Malmaison	Walker & Co.	Jersey	11724	5,985	6·92	414·70	
Rhodora II. of Dalebank ...	D. Malcolm ...	do. ...	8451	6,286	5·79	364·01	
Daisy of Garden Hill	W. Padbury ...	do. ...	1628	5,785	6·18	357·95	
Mamselle Mimi of Hamel Lea...	A. H. Henning	do. ...	10046	5,166	5·37	277·85	
Mokine Empire's Lily V. ...	T. H. Wilding	do. ...	10635	5,725	6·67	382·09	
Annetta 3rd of Woollongbar ...	W.A. Government	Guernsey	589	4,963	1·05	300·39	
Gem of Moorlands	P. Rose ...	Jersey ...	8937	5,161	4·86	251·17	
Dairymaid 6th of Gleneira ...	W. G. Burgess	Ayshire	8513	5,770	4·12	238·05	
Virginia of Nundorah	A. W. Padbury	Guernsey	778	3,941	5·34	210·56	
Thelma of Blackheath	H. O. Timms ...	M.S. ...	12847	5,063	4·03	204·50	
Lady Fowler 14th of Dardanup	R. H. Rose ...	Jersey ...	12093	7,220	5·38	388·37	
Lady Fowler 17th of Dardanup	do. ...	do. ...	11695	5,766	5·75	331·64	
Lady Fowler 13th of Dardanup	D. Malcolm ...	do. ...	8986	7,036	4·43	312·15	
Dunalister Manakin's Perce's Capture II.	R. H. Rose ...	do. ...	10392	4,730	5·99	283·76	166
Alice of Blackheath	Wooroloo Sanatorium	M.S. ...	N.Y.A.	6,616	4·29	264·66	
Lady Fowler 18th of Dardanup	T. L. Rose ...	Jersey ...	12830	4,650	5·58	259·90	
Mokine Noble Lily	Walker & Co.	do. ...	11795	4,872	4·99	243·22	
Beauty of Sarnia	D. Malcolm ...	do. ...	12086	3,860	5·91	228·29	
Fancy's Pride of Ventonia ...	T. L. Rose ...	do. ...	12829	4,417	5·03	223·47	
Lily of Roelands	D. J. Goyder ...	do. ...	10619	4,881	4·43	216·64	
Jessimia of Sarnia	D. Malcolm ...	do. ...	12088	4,293	4·67	200·64	
Campaniles Maid of Garden Hill	R. H. Rose ...	do. ...	8935	9,235	5·53	511·18	
Lady Fowler 4th of Dardanup ...	D. J. Goyder ...	do. ...	10004	7,846	5·42	425·72	
Wild Rose II. of Garden Hill...	W. Padbury ...	do. ...	10091	6,534	5·77	377·03	
Noreen 5th of Garden Hill ...	do. ...	do. ...	7125	5,713	6·07	346·96	
Ettie IV.	do. ...	do. ...	2889	7,683	4·44	341·43	
Cheerful II. of Yarralla ...	A. H. Henning	do. ...	6258	5,799	5·57	323·29	
Gladness of Woollongbar ...	Department of Agriculture	Guernsey	452	5,967	4·88	291·45	249
Milton's Syringa	A. W. Padbury	do. ...	503	6,465	6·22	402·07	
Lady Fowler 7th of Dardanup ...	T. L. Rose ...	Jersey ...	10006	7,188	5·11	367·73	
Daisy Vale of Grass Vale ...	R. H. Rose ...	do. ...	8474	8,143	5·71	465·45	
Lady Fowler 10th of Dardanup	do. ...	do. ...	10009	6,297	5·12	322·62	
Rocket of Woollongbar ...	Department of Agriculture	Guernsey	541	6,018	4·85	291·89	
Treasure III. of Homeleigh ...	D. Malcolm ...	M.S. ...	N.Y.A.	8,829	4·68	413·77	
Lily of Grass Vale	R. H. Rose ...	Jersey	8497	8,772	5·03	442·87	
Morden Lady of Koogan ...	A. W. Padbury	Guernsey	722	10,296	3·78	389·41	
Lady Fowler 12th of Dardanup	R. H. Rose ...	Jersey	10011	8,065	4·81	388·15	
Rhodora II. of Dalebank ...	D. Malcolm ...	do. ...	8451	6,286	5·79	364·01	207
Madge II. of Dalebank ...	do. ...	do. ...	8449	5,180	6·36	329·80	
Velvet of Woollongbar	Department of Agriculture	Guernsey	774	5,703	4·25	242·79	
Lady Fowler [illegible]th of Dardanup	T. L. Rose ...	Jersey	10010	6,996	5·76	403·42	
Sheila of Sarnia	D. Malcolm ...	do. ...	8452	5,392	6·21	334·99	
Gladness II. of Wollongbar ...	Department of Agriculture	Guernsey	631	4,299	5·77	248·39	
Mokine Empire's Lily 7th ...	T. H. Wilding	Jersey	11794	6,755	5·74	388·31	166
Wild Rose III. of Garden Hill ...	W. Padbury ...	do. ...	N.Y.A.	5,077	5·52	280·34	
Queen of Sarnia	D. Malcolm ...	do. ...	12091	4,173	4·92	205·37	
Carnation III. of Greyleigh ...	do. ...	M.S. ...	N.Y.A.	5,600	3·49	195·51	
Picton's Trequean Flirt ...	A. W. Padbury	Guernsey	747	9,093	4·94	449·81	207
Milton's Daisy II.	do. ...	do. ...	922	6,976	5·39	376·19	207
Lady Betty II. of Koogan ...	do. ...	do. ...	872	7,728	4·29	330·07	249
Yarraview Bonnie Annie ...	do. ...	do. ...	574	8,656	6·39	553·53	249
Virginia of Nundorah	do. ...	do. ...	778	5,713	5·45	312·37	207

Name of Cow.	Owner.	Breed.	Herd Book No.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Standard required (lbs. fat.)
				lbs.	%	lbs.	
Colleen of Rosewood	A. W. Padbury	Guernsey	819	5,673	5·61	318·40	166
Mokine Clove Carnation ...	Walker & Co.	Jersey	11796	4,779	6·70	320·52	166
Nymphea of Juadine	do. ...	do. ...	12081	4,444	5·87	261·15	166
Mokine Picotee	do. ...	do. ...	8486	5,436	5·90	321·02	249
Mokine Noble Lily	do. ...	do. ...	11795	6,367	4·85	308·74	207
Golden Pearl 4th of Wollongbar	W.A. Government	Guernsey	863	6,882	5·60	385·79	166
Silver Bell of Roelands ...	A. H. Henning	Jersey	10047	8,397	4·82	405·14	249
Fancy of Liryclea	do. ...	do. ...	6674	9,114	4·83	437·40	249
Bolebek Frieda	A. L. B. Lefroy	Fresian	1116	8,664	3·50	303·79	249
Bolebek Roma	do. ...	do. ...	1124	8,268	3·75	310·91	207
Lady Fobes Veeman	do. ...	do. ...	620852 U.S.A.	16,533	3·17	524·88	249
Bolebek Dulcena	do. ...	do. ...	1120	8,475	3·62	307·16	207
Bolebek Dorothea	do. ...	do. ...	293	7,306	3·78	276·88	249
Bolebek Judith	do. ...	do. ...	291	14,164	3·16	448·72	249
Netherland Colanthe Princess of Lydholme	do. ...	do. ...	932	7,200	3·69	266·28	166
Bolebek Joy	do. ...	do. ...	1117	9,840	3·79	373·26	249
Netherland Johanna of Lydholme	do. ...	do. ...	1355	8,055	3·69	295·35	166
Handsome Girl of Calcamine ...	G. C. Spencer	Jersey	10061	3,615	6·55	207·51	207
Blossom of Calcamine	do. ...	do. ...	10058	4,465	5·44	243·19	166
Lonesome of Calcamine ...	do. ...	do. ...	13439	3,808	5·82	221·86	166
Madge of Sarnia	D. Malcolm ...	do. ...	13437	5,863	5·74	336·97	166
Myrtle XII., Greyleigh... ...	do. ...	I.M.S. ...	N.Y.A.	4,557	4·04	184·49	166
Lady Fowler XIII. of Dardanup	do. ...	Jersey	8986	7.981	5·53	441·27	207
Girlie of Sarnia	do. ...	do. ...	9992	10,039	5·11	513·12	249
Maranora of Tellaraga	R. H. Rose ...	do. ...	6707	11,509	5·04	580·48	249
Fairy of Dardanup	do. ...	do. ...	8942	11,235	4·80	539·41	249
Jean II. of Grass Vale ...	do. ...	do. ...	9996	8,248	6·01	495·72	207
Dunalister Mannakins Perees Capture II.	do. ...	do. ...	10392	5,652	6·05	342·20	207
May of Blackheath	Sanatorium, Wooroloo	M.S.	N.Y.A.	12,156	3·99	485·14	207
Mokine Empire Lily V. ...	T. H. Wilding	Jersey	11794	5,197	6·99	363·41	207
Mokine Fancy	do. ...	do. ...	8484	8,641	5·83	504·47	249
Mokine Woodbine	do. ...	do. ...	8487	6,901	5·63	388·84	249
Daisy II. of Garden Hill ...	Walker & Co.	do. ...	10629	6,759	5·20	352·06	207
Creamy of Calcamine	G. C. Spencer	do. ...	10631	5,113	6·03	308·33	249
Primrose of Calcamine	do. ...	do. ...	10062	4,117	5·83	240·18	207

TRIALS WITH IMPORTED VARIETIES OF LUPINS.

I. THOMAS, Superintendent, Wheat Farms, and F. L. SHIER,
Agric. Cadet.

In the December number of this Journal for 1924 a preliminary report was made of the results of some 49 varieties of Lupins imported from Germany. Since that date further notes on the growth of these lupins as compared with the ordinary blue-flowered local variety have come to hand from the Experiment Farms.

The imported lupins were of three distinct types, and were classed by the donors as:—(a) Field Varieties, (b) Garden, (c) Perennial.

It is reported that the field varieties are the best suited for agricultural purposes in Germany. In that country they do well on sandy soils and ripen early and evenly under favourable conditions. They are grown very

largely for seed, part of which is used for the feeding of livestock after the alkaloids, which are poisonous, have been removed by soaking, and part is used for green manuring either alone or in conjunction with vetches, peas, or horse beans.

They class under garden varieties those considered only suitable for decorative purposes. Some of these varieties have done well here, and compare favourably with our local type, and will undoubtedly be of more use than for garden purposes.

The perennial varieties have been used extensively in Germany for the binding of sand plains and dunes, and for preparing land for re-afforestation.

Unfortunately these seeds did not arrive until the end of June, and consequently planting was rather later than is considered usual for lupins.

Small plots of each of the varieties with the ordinary lupin at regular intervals for control purposes were planted at each of the Experiment Farms. The Merredin planting was on heavy forest land manured with the usual farm dressing of superphosphate, namely, 95lbs. per acre. At Chapman the land used for these experiments was a light sandy loam, which received in addition 90lbs. of superphosphate and 28lbs. of potash.

Below are the compiled results of observations made by Messrs. E. J. Limbourne and D. R. Bateman, seedsmen at Merredin and Chapman Experiment Farms respectively:—

ANNUAL GARDEN VARIETIES.

Registration No.		MERREDIN.	CHAPMAN.
P. 1647 P. 1662 P. 1659	*Lupinus hirsutus albus* ... *Lupinus hirsutus carneus* ... *Lupinus hirsutus caeruleus*...	All similar in type to the local variety but making about twice the growth, with larger seeds. Germination was poor.	Only differing from the local variety in the colour of the flower, but making larger growth, with larger seed pods and seed about twice the size of those of the latter.
P. 1674 P. 1693 P. 1671	*Lupinus affinis* ... ... *Lupinus nanus caeruleus* ... *Lupinus nanus albus* ...	Germination in these three varieties was good while growth was somewhat more bushy in the first two. They may prove useful for ploughing in.	Growth, which was tender and somewhat spreading was very fair in these varieties. Germination was good.
P. 1666 P. 1654 P. 1650 P. 1658 P. 1681 P. 1663 P. 1655 P. 1680 P. 1656	*Lupinus succulentus* (bicolor) *Lupinus pubescens* ... ... *Lupinus hibridus atrococcineus* *Lupinus Cruikshankii densiflorus* *Lupinus hibridus roseus* ... *Lupinus pulcherrimus* ... *Lupinus venustus* ... ... *Lupinus pubescens elegans* ... *Lupinus Californicus* ...	Germination good. Early growth spreading but later becoming more erect and bushy. Very prolific seeding. P. 1656 (*Lupinus Californicus*) is probably the best, of this type.	Germination was generally good amongst these varieties, but growth was somewhat slow and poor and not comparable to that of the local variety. Perhaps the best of this section are:—P. 1680 (*Lupinus pubescens elegans*), P. 1656 (*Lupinus Californicus*.)
P. 1682 P. 1669 P. 1653 P. 1672 P. 1692 P. 1649 P. 1645 P. 1665 P. 1668	*Lupinus linifolius* ... ... *Lupinus Cruikshankii* ... *Lupinus mutabilis* ... ... *Lupinus pantelericus* ... *Lupinus albococcineus* ... *Lupinus roseus splendeus* ... *Lupinus albococcineus roseus* *Lupinus alboviolaceus nanus* *Lupinus albococcineus nanus*	On the whole germination was poor, but the later growth was vigorous and erect. P. 1649 very similar to P. 1653 but probably not quite so good. P. 1645, 1665, 1668 all similar in type to P. 1692 but not so good.	Germination was fair to good with later growth strong, resulting in tall tough stems. P. 1649 tall and similar to P. 1653 but not quite so good. P. 1645, 1665, 1668 similar in type to P. 1692 but very much poorer.
P. 1678 P. 1660 P. 1675 P. 1664	*Lupinus Hartwegi*, blue ... *Lupinus Hartwegi, albus* ... *Lupinus Hartwegi roseus* ... *Lupinus hirsutissimus* ...	Germination was poor in these varieties while later growth was only fair. Most of these plants are covered with hairs, which become very hard and sharp on maturity, and would, therefore, be troublesome to stock.	Germination and growth were very poor in these varieties.

The following Garden Varieties were practically failures at both farms :—

Registration No.		MERREDIN.	CHAPMAN.
1646	*Lupinus Dunetti atroviolaceus*	Very slow in growing. No seed obtained.	Very slow growth, does not appear fixed.
1652	*Lupinus Guatemalensis* ...	Poor, no seed harvested ...	Very poor, only one plant secured for seed.
1661	*Lupinus subcarnosus (texanus)*	Failure	Failure.
1667	*Lupinus Moritzianus* ...	Very late, no seed obtained	Very poor.
1670	*Lupinus luteus Romulus* ...	Poor	Very poor.
1673	*Lupinus concinnus* ...	Failure	Poor.
1677	*Lupinus sulphureus Menziesii*	Failure	Failure.
1679	*Lupinus hibridus fl. pl. President Cleveland*	Failure	Poor.
1683	*Lupinus hibridus insignis* ...	Poor	Only fair.

FIELD VARIETIES.

P. 1686 P. 1688 P. 1684 P. 1687	Merckel's "Liebucher" red Prof. Romer's "Victoria" *Lupinus angustifolius*, blue Prof. Romer's *Lupinus angustifolius*, white Prof. Romer's *Lupinus angustifolius*, dark blue	These varieties made better growth and seeded better than the ordinary lupin. They are erect growing, flowering and maturing at the same time as the local variety. The local lupin remained greener longer under the dry conditions than the imported varieties.	All the field varieties made very fair compact growth, and promise to be of value. Germination was good in all these varieties.
P. 1685 P. 1690 P. 1689	Prof. Romer's *Lupinus luteus*, yellow v. Calben Vienauer—*Lupinus luteus*, yellow Belbe-Hindenburg Templin —*Lupinus luteus*, yellow	These are more spreading types than above. They were badly affected by frosts and growth was poor. They are not at all promsiing.	

PERENNIAL VARIETIES.

The following is a list of perennial varieties planted, which, under conditions of climate, failed to mature:—

P. 1676—*Lupinus arboreus hybr.* (New.)
P. 1648—*Lupinus nutkaensis.*
P. 1651—*Lupinus polyphyllus Excelsior.*
P. 1657—*Lupinus imperialis roseus.*
P. 1691—*Lupinus polyphyllus.*

BATHURST BURR.

(*Xanthium spinosum*, L.)

W. M. CARNE, F.L.S., and C. A. GARDNER.

Bathurst Burr is an annual shrubby plant occurring in a few places in Western Australia. It owes its name to the fact that it first received prominent attention at Bathurst, New South Wales, before the year 1850, when it appears to have been introduced in the manes and tails of horses imported from Valparaiso. Originally confined to roadsides it soon spread in all directions, and now it is common in all the States of Australia. Its introduction into Western Australia must have been comparatively recent; we have no record of this, but it does not appear to have existed here until after 1870 and probably much later.

The generic name *Xanthium* is derived from the Greek *Xanthos*: yellow; some of the plants were used in ancient times to obtain a yellow dye. The specific name *spinosum*, which is of Latin derivation, alludes to the strong spines possessed by the plant. The species is now almost cosmopolitan, and it is practically impossible to trace the country of its origin, but it is probably either the Mediterranean region, or South America.

Bathurst Burr is the worst of our noxious weeds. Fortunately it has not obtained the same hold upon this State that it has elsewhere, and therefore it is necessary to take every precaution possible for its extirpation. The plant does not possess a single good quality, being useless as a fodder, a serious trouble in wool, and a nuisance in taking possession of land. It has even been suspected of being poisonous, but this lacks any proof. It may, however, cause mechanical injury to animals should they eat it, which is improbable.

So serious is this weed as a pest that in Eastern Australia it is regarded as being second only to Prickly Pear, and the losses sustained annually amount to some thousands of pounds.

Bathurst Burr has been declared a noxious weed under the Noxious Weeds Act for the whole of Western Australia, and the Road Boards and other local governing bodies are responsible to see that it is eradicated on both private land and in the areas under their control. The Railway authorities are responsible for its destruction on Railway property.

Description of Plant.

A rigid widely-branched shrub of from 1—3 feet high, with narrow, usually three-pointed leaves green above and white underneath, armed with triple spines at the bases of the leaves. Flowers are very small and in clusters at the bases of the leaves, or almost solitary—of two kinds—the upper ones male, and the lower female. The latter are not stalked, and when in fruit form oblong burrs usually half an inch long and densely covered with hooked prickles, which are all curved upwards. These burrs (fruits) are each two-seeded.

The effects of Bathurst Burr and its distribution.

Unlike most members of the Daisy Family (*Compositae*) to which Bathurst Burr belongs, the fruits are not distributed by the wind, but are well adapted to animal distribution. They are covered with small hooked burrs, and readily attach themselves tenaciously to the hair and fleece of animals, or the clothing of man.

Bathurst Burr.
(*Xanthium spinosum*, L.)

A.—Portion of stem with lateral branches.
B.—Young leaf with spines.
C.—Fruiting head or burr.

The fleeces of sheep and the fetlocks, manes and tails of horses, also the tails of cows serve as their principal distributing agents in this country. The presence of the burrs in wool seriously impairs its value as they are extremely difficult to extract.

Bathurst Burr spreads rapidly when once established in a district, especially if assisted by summer rains. The plants tend to form colonies which may extend over quite large areas if allowed to do so, to the exclusion of all other herbaceous growth. They seed freely, and the seeds may lie in the soil in a dormant condition for several years. The burrs are two-seeded. Only one of these may germinate in one year, and the other may remain dormant for some time producing a second plant at a later stage.

Since animals are so largely responsible for the dispersal of seeds, it is only natural that we must look to stock yards and paddocks for its appearance, and principally to the larger saleyards and stock pens for its introduction. We find, therefore, that the plant is established at Kalgoorlie. It has appeared at Robb's Jetty near Fremantle, and around some of the stockyards of the metropolitan area, but these places are under supervision, and in some of them it has been completely eradicated. It has also made an appearance at Pingelly and a few other scattered centres.

Bathurst Burr must, therefore, be looked for in spots where animals stay while in transit, and it should be eradicated upon its first appearance. Where present on railways or roadsides it should be even more closely watched, for these are the arteries along which it is likely to spread by passing people, stock or vehicles.

Control.

It is important to prevent the weed from seeding. This can be done by either grubbing it out or cutting it down before the plant is fully grown or has matured seeds, and it is advisable to burn the plants as soon as they are sufficiently dry, to doubly ensure the destruction of seeds. Cultivation at the proper time, repeated if necessary, should suppress the plant.

THE KITCHEN GARDEN.

G. N. LOWE,

Senior Potato Inspector.

The Carrot.—This vegetable is very easily grown in almost any class of soil, although it thrives best in a deep friable loam. Clay can be made to produce good crops, but, of course, requires even better treatment than is necessary with more easily worked lighter soils. Whatever class of soil is planted to this crop one condition must always be observed: this being that the fertiliser, whether it be farmyard or artificial, should not be applied just prior to planting.

The best results are returned from a plot which has been heavily manured for some previous crop, such as cabbage or cauliflower. It must be remembered that newly manured land causes carrots to become "forky" and misshapen, this being brought about by the insufficient incorporation of the fertiliser with the soils.

Artificial fertilisers will prove beneficial, the weight of the application depending upon the richness or otherwise of the land selected for planting.

A mixture of superphosphate or bonedust and sulphate of potash in the proportion of four parts of the former to one of the latter will be found to give good results if applied at the rate of 3 to 4 cwt. per acre or 2 or 3 lbs. per square rod.

As with all other root crops, potash is required to form in the carrot the maximum amount of starch and sugar, and particularly should this portion of the plant's requirements be furnished adequately in sand, where no natural supply is available.

Artificial manures of correct make up, together with adequate supplies of water, will tend to quick growth, early maturity, and the crispness which is so desirable in every vegetable. Care in this direction will be well repaid.

A most important factor in connection with the preparation of the soil is that it should be well and deeply worked and that the preparation should begin early.

The seed should be planted in rows 9 to 12 inches apart, or, where a large area is planted, up to 15 inches, so that the wheeled hoe of the Planet Junior or Iron Age type may be used and hand hoeing reduced to a minimum.

The seed may be sown either by hand or by means of a hand seed drill. One method employed satisfactorily in this operation is to obtain a wide-mouthed bottle, such as is used for pickles, and a quill or small tube inserted through the centre of the cork, through which the outflow of seed is very easily controlled by the first finger.

Owing to the peculiar hooked formation of the seed, evenness of sowing will be more easily attained if it be mixed with a proportion of clean dry sand, as this will largely prevent the tendency of the seeds to stick together.

Fresh seed should be used always and the depth to plant is about half an inch. After planting the soil should be firmed with the back of the spade and the surface then raked ever so lightly to prevent caking and loss of moisture.

If the germination be good it will be found necessary to thin the plants to three or four inches apart to allow of a proper development. The larger ones may be removed first and so the usefulness of the bed increased.

An early winter sowing, followed at intervals of about three weeks by others—or a succession—as it is termed, will provide a succulent nourishing adjunct to the house-keeping requirements right through to the summer.

In suitable soils and localities sowings can, of course, be made through the summer months and good crops obtained.

For the earliest crop Early Horn or Early Nantes, the "shorthorn" varieties, will be found most suitable and particularly for shallow soils. For main crop and on deep soils the long varieties such as Intermediate, Altringham, Danvers, and Manchester Table should be chosen.

Carrots to be at their best should be pulled a little before reaching full maturity and before the roots get tough and coarse.

Should any difficulty be experienced in heavy soils in the pulling operation, the earth about the roots can be loosened by means of a fork and the roots withdrawn without risk of breaking.

WHEAT YIELDS COMPETITION.

I. THOMAS,

Superintendent of Wheat Farms.

In presenting the results for 1925 it is gratifying to observe that there is a marked increase in the number of entrants who filled in their entirety the qualifying conditions attached to the Wheat Yields Competition. It will be remembered that in the preliminary tests conducted last year, and outlined in the March, 1924, issue of the *Journal*, out of 41 original entrants 31 withdrew either voluntarily or by default, leaving only 10 actual participants in No. 1 and No. 2 Zones, whilst No. 3 Zone lacked a single entrant. This year No. 3 Zone had one competitor who fulfilled all the conditions. In both No. 1 and No. 2 Zones there were seventeen competitors respectively. Of these, one in No. 1 Zone and two in No. 2 Zone failed to submit the necessary dockets, and in No. 2 Zone another competitor voluntarily withdrew owing to the large area of sand-plain which he was cropping. There were thus this year 31 farmers who entered this competition and completed the test, and this may be accepted as evidence of awakened interest in the matter. Further evidence of this is shown by the fact that the judges found great interest displayed throughout the wheat belt as a whole in the competition. One feature of the competition which appeals most strongly to farmers is the fact that the whole of the stripped area has to be taken into account, and the actual returns, as disclosed by the sales dockets, and by actual inspection by the judge of seed on hand, are the only accepted evidence of yield.

There is a general belief amongst the competitors in the advantages of fallowing in promoting high and profitable yields, and in consequence a determined effort to plant as much as possible in fallowed land. There is also more similarity in the methods of fallowing than with any other of the operations connected with the production of the crop. The first operation of breaking the land is done during the months of June, July and August, and the general aim is to commence and complete this work as soon as possible. The ploughed land is then invariably cultivated twice in the spring and again before seeding. Some competitors also cultivate during the summer to destroy weeds and mainly after rain.

The implements used vary and are usually such as are adapted to the condition of the soil at the time. The rate of seeding in Zones 1 and 2 ranges from 45 to 70 lbs., 60 lbs. being the more common amongst the competitors who obtained an average yield of over 20 bushels. The application of superphosphate varies from 45 lbs. to 150 lbs., and in No. 1 Zone 90 lbs. is more frequently used than any other; in No. 2 Zone a larger amount, of 100 lbs. and over, is preferred. A general tendency to increase the rate used in former years is noticed despite the increase in the quality now supplied. The month of May may be regarded as the favourite time for planting, and after rain if possible.

The yields which have been obtained in both zones—up to 26½ bushels—show that the competitors have established a very high standard, and a standard which a few years ago would have been regarded as entirely impossible of achievement. What has been done in this respect is having an inspiring influence upon the yield of the general body of farmers throughout the wheat belt, and its effect must increase.

The judging was carried out on similar lines to that adopted in connection with cropping competitions, but, in addition, the actual areas stripped were measured for the purpose of calculating the average yield when the dockets were submitted.

The marks allotted to the competitors in No. 1 Zone are as follow:—

WHEAT YIELD COMPETITION.

No. 1 ZONE.

Competitor.	District.	Acreage.	Average Yield per acre.		Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Grand Total.
			Points		35	25	15	15	10	100
			bus.	lbs.						
Lindsay, J. ...	Wyalkatchem...	390	26	35	27	21	13	13	7	81
Dunkley, G. ...	Yelbeni ...	500	25	55	26	21	13	12	7	79
Hughes Bros. ...	Minnivale ...	347	24	15	24	21	13	13	7	78
Hammond, J. D.	Kellerberrin ...	567	23	9	23	21	13	13	7	77
Lethlean, J. ...	Bruce Rock ...	390	24	3	24	21	12	13	7	77
McCarthy, P., & Son	Eujinyn ...	765	23	49	24	20	12	13	7	76
Dumsday, L. ...	Goomarin ...	335	21	25	21	19	12	12	6	70
Ball, H.	Yelbeni ...	600	19	11	19	18	12	11	6	66
Spillman, J. W. ...	Nth. Baandee	510	18	13	18	18	12	11	6	65
Spillman, D. J. ...	do. ...	410	17	24	17	18	12	11	6	64
McManus Bros. ...	Nth. Bencubbin	385	11	38	12	21	13	12	6	64
Pollock, R. ...	Belka	541	14	54	15	18	11	12	6	62
McLellan, J. ...	Mt. Stirling ...	360	14	47	15	18	12	11	6	62
Lehmann, C. E. ...	Dukin	600	13	2	13	18	12	12	6	61
Bradford, R. and L.	Ballidu ...	395	10	25	10	18	12	12	6	58
Bell Bros. ...	Dalwallinu ...	1,410	14	56	15	15	12	8	5	55

The following details regarding the two prize-winners for No. 1 Zone, as supplied by the judge—Mr. H. Rudall—are given:—

"Mr. Lindsay's farm is situated six miles from Wyalkatchem. The holding comprises 1,320 acres, of which 1,250 are cleared. Of this area there were 420 acres under wheat, 290 under oats, and 480 acres of fallow. Of the area under wheat 30 acres were cut for hay, leaving 390 acres to be stripped for grain, which yielded an average of 26 bushels 35 lbs. The land under wheat was ploughed 4in. deep in the previous June and July with a mouldboard plough. In August it was then cultivated with a Spring Tyne cultivator. With the exception of a small homestead paddock, the whole was double-disced in September, and then again cultivated with a Spring Tyne in October. It was harrowed after rain in January, and cultivated with a Spring Tyne in March and April, just before sowing. The seed used was graded, and treated with bluestone to prevent smut, and was second-year removed from the pedigreed seed obtained from the Experiment Farm. The whole area, with the exception of 50 acres in the homestead paddock, was not sown until after rain in May. The two principal varieties used were 'Nabawa' and 'Gluyas Early.' The 'Nabawa' was sown at the rate of 50 lbs. of seed, and 'Gluyas Early' at the rate of 60 lbs. The rain which fell from the 1st May to the 31st October, as recorded by the gauge on the farm, was 995 points. It is interesting to note that the average from 1915-1923, not including the competition crop, has been 19 bushels per acre from this farm. The holding is surrounded by a rabbit and dog-proof netting fence, and worked on the three years' system. Of the 290 acres of oats 100 acres were used for grazing

only. This 100 acres, together with the grazing on the fallow to keep down the weeds, carried 400 ewes and 300 lambs from May until October; of these 253 were sold as fats in October, leaving 436 to be carried over until the wheat and oat crop stubble was ready for grazing throughout the summer. The work on the farm is carried out by means of a 'Case' tractor and two 6-horse teams."

"Mr. G. Dunkley, who was awarded second place, has a holding of about 3,000 acres, eight miles from Yelbeni, of which approximately 2,200 have been under cultivation. This holding is enclosed with a rabbit and dog-proof netting fence, and subdivided into paddocks fenced with rabbit netting. This season there were 610 acres under crop, 500 being wheat and 110 oats; 410 acres of the wheat were fallowed, and 80 acres were stubble ploughed. The varieties used were 'Nabawa,' 'Federation,' 'Merredin,' 'Gluyas Early,' 'Gluyas Late,' 'Canberra,' and 'Onas.' The 410 acres of fallow were ploughed 4 inches deep during the period June to August, both mouldboard and disc types of plough being used. The ploughed land was cultivated three times before harvesting time, and twice between harvest and planting period. The crop was sown after rain, commencing on 20th May and ending on the 17th June. The rate of seeding was 60 lbs. of seed, and superphosphate was applied at the rate of 130 lbs. After drilling the ground was harrowed. Since the holding has been secured from dogs sheep have been carried, the number pastured throughout the year ranging from 500 to 1,000. This farm is worked by three 7-horse teams and tractor."

In No. 2 Zone the points allotted to the various competitors are as under:—

WHEAT YIELD COMPETITION.

No. 2 ZONE.

Competitor.	District.	Acreage.	Average Yield per acre.		Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth.	Grand Total.
			Points		35	25	15	15	10	100
			bus.	lbs.						
Keays, P. ...	Corrigin ...	495	25	29	25	23	12	12	8	80
Bowen, T. ...	Wongan Hills...	544	26	31	27	20	11	12	7	77
Dall, S. C. ...	Quairading ...	286	21	6	21	21	13	13	8	76
Morrell Bros. ...	Greenough ...	215	23	7	23	19	13	13	8	76
Ackland, R. B. ...	Wongan Hills	352	20	41	21	21	13	12	8	75
Carter & Son ...	Three Springs...	241	25	35	26	18	12	12	7	75
Richards, T. ...	Dangin ...	195	22	...	22	20	12	12	8	74
Hayward, A. L.	Dindiloa ...	230	15	7	15	22	14	14	8	73
Elder, A. ...	Moulyinning ...	361	21	16	21	19	13	12	7	72
Spencer & Son ...	Wongan Hills...	264	22	53	23	19	11	12	7	72
Mott, C. ...	Moulyinning ...	178	20	37	21	19	13	12	7	72
Gottsch Bros. ...	Dudinin ...	617	15	53	16	20	13	13	7	69
Nicholls, Robt. ...	Kondinin ...	426	14	8	14	19	12	12	7	64
Hebiton & Sons...	Three Springs...	*218	*	*	*	19	13	12	8	52

* Half of this Competitor's acreage was destroyed by hail.

The total area of the holding of the winner in this zone, Mr. P. Keays, is 2,500 acres, of which 1,500 acres are cleared, consisting mainly of salmon gum and gimlet, with a little morrell, jam and York gum country. The area stripped for wheat for the competition was 495 acres, 100 of which was ploughed prior to planting, the balance being fallowed during the winter months. The fallowed land was ploughed 4 inches deep between the months of June, July, and August. On the heavier land a mouldboard plough was

used, and a disc on the lighter soil. The subsequent cultivation was commenced when the ploughing was completed, and was carried out largely by means of the Spring Tyne cultivator, but, if found necessary, a disc cultivator was used to deal with the earlier ploughed land, which had been "set" by the rains and was too hard for the Spring Tyne cultivator. The general system adopted was to cultivate about twice during the spring, and again just prior to seeding, but this was not rigidly adhered to, the cultivation given to the fallow being governed by its condition, the object aimed at being to obtain a seed bed free from weeds and with a uniform loose mulch. The condition of the ground determined what type of implement was necessary to achieve the desired result. The varieties used were "Belka," "Nabawa," "Merredin," and "Gluyas Early." The seed was treated with bluestone to prevent smut, and was sown at the rate of 60 lbs. per acre for "Gluyas Early" and 45 lbs. for the other varieties. Superphosphate was applied at the rate of 60 lbs. No sheep are kept, as facilities for this purpose are not yet provided. This competitor realises the necessity for fallow and is aiming to reach the stage when he will plant entirely upon fallowed land, and this year the area fallowed for next year's crop is 450 acres. One 6-horse team and a tractor are used. The earlier sown crops were harrowed during June and July on account of the dry spell. A similar dry spell was experienced in September, but fortunately this was followed by good rains in October. Planting commenced the second week in April and finished the last week in May.

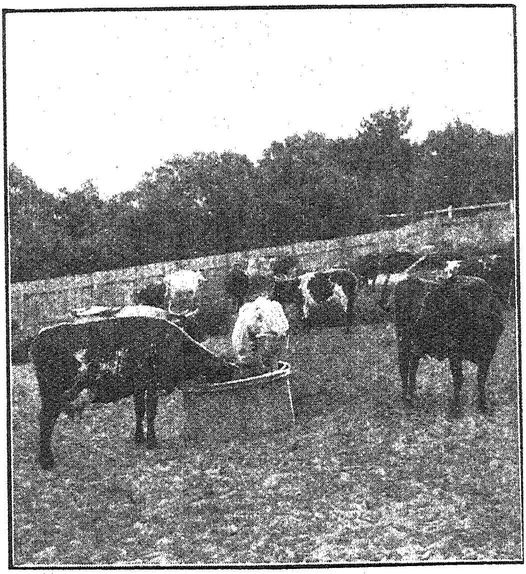
The second prize winner, Mr. T. Bowen, had two farms competing in the Wongan Hills district, and, under the conditions of the competition these farms had to be treated as one entry, even though they were 21 miles apart. The total area of both farms is 2,300 acres. The area stripped was 544 acres, and consisted mainly of salmon gum, morrell, and York gum, with a little ti-tree country. The land had been ploughed four to five inches deep during June and July with a mouldboard plough, and cultivated with a Spring Tyne implement immediately after ploughing. It was also cultivated after rain during the summer with the same implement except where the rain had set the soil, and then with a disc cultivator. The varieties used were "Nabawa," "Federation," "Gluyas Early," and "Gresley," the seed of which had been graded and portion pickled. Seed was sown at the rate of 60 lbs. per acre, with an application of superphosphate at the rate of from 100 to 110 lbs. The general system of working the farm was fallow and crop, but it is now intended to work it on the three-course system of fallow, crop and pasture.

Credit must be given to Messrs. Hebiton & Sons, Three Springs, for the very good crop which they had, but who were extremely unfortunate in suffering heavy losses by hailstones, estimated by them to be approximately one-half their yield, for they were well to the fore in regard to points awarded for sound methods of cultivation.

In No. 3 Zone Mr. W. Sewell was the only competitor to compete with a stripped area of 295 acres, from which an average was obtained of 14 bushels to the acre. The points awarded to this competitor were:—Yield, 15 points; freedom from weeds, 22 points; freedom from disease, 12 points; freedom from admixture, 13 points; evenness of growth, 7 points; making a grand total of 69 points out of a possible 100.

Mr. Sewell has been public spirited enough to offer to withdraw from this competition in order that a new one may be commenced, thus affording others in his zone an opportunity of competing and also representing the zone.

Mr. Sewell is to be commended for his sportsmanship in voluntarily relinquishing any advantage he has in connection with this Championship Competition, and which he might have secured by being the only competitor in Zone 3. His offer has been accepted, and the competition will now be thrown open to others eligible for entry in that zone. Those entering this year will have equal opportunity with Mr. Sewell, for it has been decided that the competition in Zone No. 3 shall run for two years only so that it will end simultaneously with the competitions in Zones Nos. 1 and 2. It is to be hoped that Mr. Sewell's generous offer will meet with a deserved response from the farmers concerned, and that the friendly rivalry which will result from this competition will stimulate competitors in that zone to secure increased yields. Entries for the 2-years' competition in this zone will, therefore, close on September 1st, 1925, with the Secretary, Royal Agricultural Society, Perth.



WHEAT YIELDS COMPETITION.

Entries Invited for Zone No. 3.

Owing to the action of Mr. W. O. Sewell, of Pingelly, the only competitor in Zone 2, who generously withdrew and forfeited the advantage he had of a "walk-over," a new Wheat Yields Competition extending over two years in Zone 3 has become possible.

In this zone, which comprises the districts having an annual rainfall of 20 inches or over, a Champion Cup, valued at £20, will be awarded to the competitor who, during the next two consecutive seasons, obtains the highest aggregate number of points for the whole of the wheat crops which he harvests for grain.

In addition to this Champion Cup there will be awarded each year two prizes, valued respectively at £5 and £3, to the competitors who are judged to obtain first and second places in the competition in each of these years.

The minimum area to be stripped for competition purposes is 150 acres, this small area having been chosen so as not to exclude settlers who follow sound farming work by devoting a portion of their crop to oats and fodder crops. Any portion of the crops which are cut for hay must be taken in distinct blocks so as to satisfy the judge that such portions have not been removed with the object of trimming the grain crops, and thus probably enhancing their yield. The area of any farm in which a competitor is financially interested must be included in this competition.

The awards will be made in accordance with the following scale of points:—Yield, 35 points; freedom from weeds, 25 points; freedom from disease, 15 points; freedom from admixture, 15 points; evenness of growth, 10 points; making a grand total of 100 points.

The prize winners each year, and the winner of the Championship, must exhibit one bag of wheat at the Royal Agricultural Show held subsequently to the award. The points allotted for yield will be determined by the actual quantity of wheat sold, or remaining on the farm for farm use. A competitor must supply to the judge docket notes of the wheat sent from the farm, and furnish such other information as may be required in connection with the grain harvested from his crop. He must arrange for the judge to be met on arrival of the train at the nearest siding, and convey him to the train on return. The time of judging will be arranged, and the judge will be appointed by the Director of Agriculture. The judge's decision in all matters will be final.

Entries for this competition in this zone will close on 1st September, 1925, with the Secretary, Royal Agricultural Society, Perth.

VITICULTURAL NOTES FOR JULY, AUGUST, AND SEPTEMBER.

H. K. JOHNS,

Viticulturist.

JULY.

During this month work in the vineyard is confined mainly to pushing ahead with pruning, burning-off, ploughing, etc., as the days are short and there is a percentage of wet ones as well: consequently vineyard work, except in a few dry and hilly localities, is hindered. Land should be marked out for new plantations, and the planting of young rooted vines proceeded with. Land where clay subsoils and hard pan occur should be well trenched, and a thorough method of drainage on all low-lying country should be brought into operation. All young vines planted last season should be permanently staked or trellised.

Cellar.—The first racking of young wines should have been completed, and all dry wines filled up regularly.

AUGUST.

The pruning of all vines should be completed before the end of this month, as well as the tying down of rods of long-pruned vines; also removal of all prunings, completion of first ploughing and hoeing, so that the land is in good tilth before the buds burst.

Swabbing and Spraying—Black Spot (Anthracnose).—Whenever this disease has become established or where any signs of it were noticed last spring or summer, swabbing will be essential, and commercial growers who desire clean crops of fruit fully realise the grave danger of neglecting swabbing or spraying. The sultana is most susceptible to this disease, while several varieties of table grapes are often very severely attacked. A two-fold treatment is generally adopted, consisting, firstly, of the winter swab or spraying, to be completed before the buds begin to swell, which is designed to destroy the wintering forms of the fungus, and secondly, spring and summer spraying with copper mixture to prevent the spread of any fungus resulting from the development of any wintering form which may have escaped destruction by swabbing.

The following is a formula which has proved satisfactory as a winter swab or spray to be applied just before bursting of the buds:—Iron sulphate, 35lbs.; sulphuric acid, 8lbs.; water, 10 gallons; or a very strong Bordeaux mixture, as follows:—Bluestone, 20lbs.; lime, 20lbs.; water, 40 gallons. Success has been met with this mixture in the Swan vineyards, and growers there favour this mixture in preference to the iron sulphate spray.

Given suitable weather conditions fresh infection will, no doubt, occur, and this must be combated with a spring treatment of copper mixture, made up as follows:—Copper sulphate, 6 lbs.; fresh quicklime, 4lbs.; water, 40 gallons.

The planting of young vines should be completed this month.

Cellar.—All young wines should have their second racking completed. Keep all dry wines regularly filled up.

SEPTEMBER.

Cultivation should receive every attention this month, ploughing to be completed, and cultivators kept briskly going where soil conditions are suitable.

Black Spot (*Anthracnose*).—Spring spraying with copper mixture, as follows, to be applied:—Copper sulphate, 6lbs.; freshly burned lime, 4lbs.; water, 40 gallons.

Oidium.—Owing to the abnormal rains and humidity during the ripening stage of the grape this season, Oidium was prevalent in most vine-growing districts, and given suitable weather conditions it will no doubt make its appearance this coming season; therefore a spraying of lime sulphur solution before flowering time will be very advantageous in checking an outbreak. This solution has certain advantages over the dry dusting of sulphur, as it vaporises at a lower temperature, and is not so easily washed off by the rain. As the season goes on dustings of sulphur should be applied on moist muggy days in the early mornings as far as practicable, at intervals of ten days, during the later growing periods of the vine.

Cellar.—Closely examine all young wines. Any doubtful wines should receive immediate attention. Rack older wines. Dry wines to be regularly filled up.

LOCUSTS.

Warning.

L. J. Newman, F.E.S.,

Entomologist.

During July or August the young locusts will be issuing from the egg tubes in the ground. Farmers and those concerned must be on the alert and take immediate action to poison off these hoppers.

1. The following formula has been found to be most effective:—

Bran	30lbs.
Molasses	5lbs.
Arsenite of Soda	1lb.

Method of Making.—Dissolve the arsenite of soda in ½ gallon of water (hot for preference). Likewise dissolve the molasses in 1 gallon of hot water. Allow both to cool before mixing the soda and molasses together. Stir this mixture into the bran until it is of such consistency that, when distributed, it will break into fine particles. *Avoid lumps.*

If not using arsenite of soda an equal amount of Paris green may be substituted. The Paris green is used and mixed with the bran in a dry form, the molasses and water being added after the bran and Paris green have been thoroughly mixed.

2. *Spray.*—The hoppers and surrounding grass and vegetation may be sprayed with the following poison:—

Arsenite of Soda	1lb.
Molasses	4lbs.
Water	16gal.

Method of Making.—Disolve the arsenite of soda in ½ gallon of hot water, likewise dissolve the molasses. When cooled add the two together, bringing it up to 16 gallons, mixing thoroughly. Keep agitated when using.

Note.—Being a poison, handle carefully, and keep all animals off foliage so treated for at least three weeks after the last application. Baits or sprays must be applied in the early morning before 10 a.m., or late in the evening, so that the bait will be fresh and tempting to the massed locusts, which have fasted all night. Locusts will not partake of a dry bait. Repeat treatment once a week until the pest is destroyed.

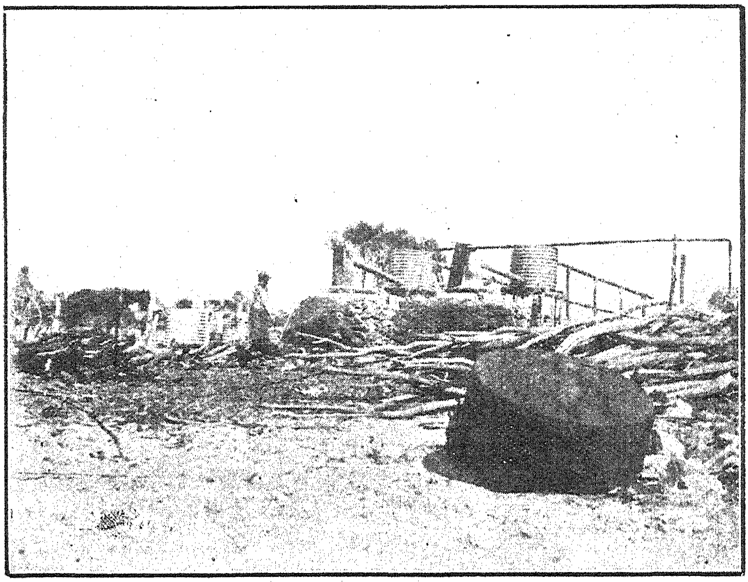
For fuller information apply to Department of Agriculture for Bulletin No. 142.

THE FARM WATER SUPPLY.

GEO. L. SUTTON,
Director of Agriculture.

Farm operations cannot be conducted without a water supply, and a plentiful supply is essential for comfort. Despite these indisputable facts, it is surprising how many farmers are enduring the privations and loss consequent upon having an inadequate supply, and how few, even amongst the more advanced, have provided themselves with the means of enjoying the benefits and comforts of the liberal supply which they have within their power to secure.

In many instances expense and hardships, due to a scarcity of water, are unavoidable during the pioneering stages, and especially during the early stages of development. A striking instance of the expense involved is furnished by the experience of Mr. Greenham, "Oakbank," Badgerin, who, when he commenced his farming operations, was compelled to cart water from the nearest well for a period of about six months. During this time he travelled twenty-seven miles each day for water, his return load was 230 gallons, just over a ton, and the aggregate distance travelled was nearly 5,000 miles. During his first harvest he was compelled to cart water for three days in order that he might use the harvester for two days.



Water Condenser at "Thirty-mile."

Even more costly and troublesome than carting water a reasonable distance is the method of providing a water supply for farm requirements by means of a "condenser," which was used when the well water available for domestic or stock purposes was too salt for consumption. In the early days water was obtained in the outback areas by the use of condensers, but now,

large agricultural areas North and South of the Eastern Railway are supplied with water from the Goldfields Water Scheme by branch pipe lines, which are laid from the main pipe lines where required.

The illustration shows one of the last of the condensers to be superseded. It was situated on the Esperance-Norseman road, and was known as the "Thirty-mile" condenser, so called because it was thirty miles from the last camping place at which there was a well. With the two boilers continually going it had a production of 2,500 gallons per week. At one time it was generally believed that, as most of the wells in that district were salt, it would be dependent upon condensers for its water supply, but fortunately since then it has been found that water can be stored in excavated earthen tanks, and the stored water supply is probably equal to that of any agricultural district in the wheat area. This experience should convey a message of hope to those whose water supply is inadequate for their requirements at present, and believed to be so for the future.

Tanks of water left for settlers at Railway Siding. This should be the last line of reserve, not the first.

In very many cases the period of a scanty water supply is unnecessarily and unduly prolonged. The causes of this are many and various, and it is believed that one of the most common in this State is the regularity of our winter rainfall, which tends to lessen the sense of responsibility regarding the necessity for water conservation, which is, however, just as essential under our favourable conditions as in other States. This avoidance of responsibility results not only in the unsatisfactory and unprofitable work of carting water often for domestic as well as stock use, but entails that great discomfort to all which is unavoidable when the farm is compelled to exist upon a famine allowance of water. In addition to being expensive it hinders, if it does not entirely prevent, the profitable performance of the cultural operations incidental to the season of the year.

Settlers who fail to realise their responsibilities in connection with water conservation rely upon public wells and tanks, and water which the State carries over the railways at less than cost. They are, indeed, fortunate in having these supplies to fall back upon, but they should, however, not be looked upon as the first line of reserve, as many now regard them, but rather as the final line to be called upon only when the fullest possible conservation has been made on the farm and become exhausted. This transported water is very costly. How much more costly it is than farm conserved water the farmers who still continue to depend upon it evidently fail to realise, or they would take steps to provide more adequate storage on the farm.

In many instances the cost to the settler at the railway is 2s. 6d. per 100 gallons: to this must be added the cost of loss (leakage) and carting to the farm, so that the cost landed at the farm is probably 4s. or 5s. per 100 gallons. One cubic yard of earth with a storage capacity of over 160 gallons can be excavated for about 1s. 6d.; allowing 10 per cent. interest on 1s. 6d., the interest charge would be less than 1¾d. for each 100 gallons storage capacity per annum. Assuming that losses by evaporation and seepage* were such that 10 times as much water had to be stored as was available for use, the cost with farmers' own storage in an earthen excavated tank would be, say, 18d. per 100 gallons instead of 48d., which is now the cost of the same quantity carted by road and rail.

Further information on this point is afforded by the following table:—

TABLE SHOWING PRICE OF WATER AT PER 100 GALLONS, AND THE CAPITAL EXPENDITURE WHICH THIS REPRESENTS.

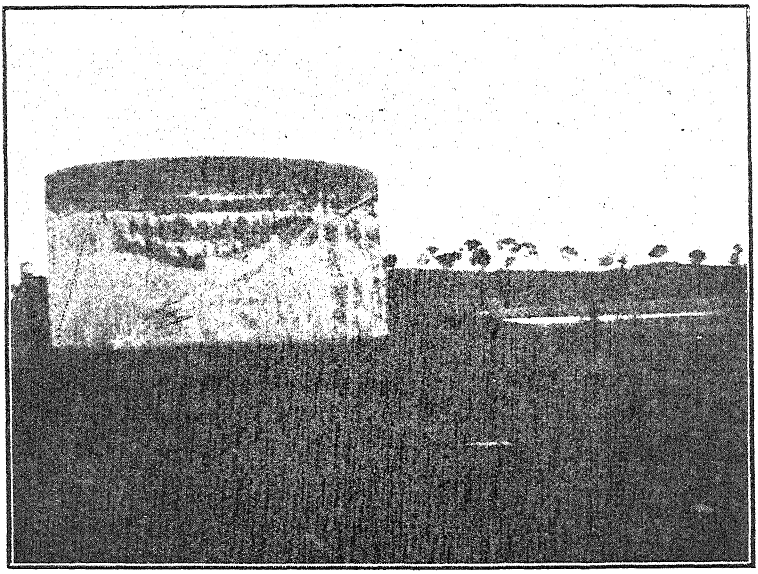
Price per 100 gallons per annum.	Capital sum represented in shillings with interest at:		
	6%	8%	10%
3d.	4·16	3·12	2·6
6d.	8·33	6·25	5·0
1s.	16·66	12·5	10·0
2s.	33·33	25·0	20·0
3s.	50·0	37·5	30·0
4s.	66·66	50·0	40·0
5s.	83·33	62·5	50·0
6s.	100·0	75·0	60·0

From an examination of this table it will be seen that it is equally as profitable for a farmer to provide his own water supply at a capital cost of 40s. per 100 gallons storage capacity, and pay 10 per cent. on the money invested as to purchase it at 4s. per 100 gallons. Almost every farmer will readily realise that he can do better than this, even if the supply required is stored in galvanised or concrete tanks. Iron tanks provide very effective water storage and cost in agricultural districts from £5 to £8 per 1,000 gallons storage capacity, according to size; this is equivalent to from 10s. to 16s. per 100 gallons. From the table above it will be seen that even if 10 per cent. interest on the money invested is required, the cost per 100 gallons at the lower price for tanks would be 1s., or one-quarter that of the transported water even if the tank were only filled once, and it is more than likely that it would be filled at least twice.

* It is believed that tanks constructed as described herein will be free from this source of loss.

Assuming that of the 168 gallons of water capable of being stored in one cubic yard of excavation, 100 are effectively conserved and available for consumption, this table further shows that 4s. per cubic yard of excavation could be spent to provide the farm water supply if the money were obtainable at six per cent., or 3s. if the interest is eight per cent., or 2s. 6d. if 10 per cent.

Only in rare instances have wheat farms a good natural permanent water supply. In many instances good water is obtained by sinking shallow wells, but in the majority of cases the necessary provision for domestic requirements can be made only by conserving the rain water as it runs off the roofs of houses and outbuildings: and for stock by excavating earthen tanks or dams in suitable sites, where the water from the catchment area can be led into them by means of drains or gutters.



A cement storage tank, "Tillellan, Wagin. Specially suitable for waters which corrode iron tanks.

For storing rain water for domestic purposes nothing better is known than either the galvanised iron or cement tank. The former has the advantage that it is lighter and can be moved from place to place, and in the small sizes is cheaper than the latter. Owing to the large amount of evaporation which takes place during the summer in hot climates, all the tanks should be covered. The "cone" top is to be preferred as it tends to throw off dust and other impurities rather than to accumulate them, and the cover will also prevent the formation of a green scum on the water.

There are quite a number who fail to realise the quantity of water available to them from roofs for storage in a district of scanty rainfall. The roofs of the homestead and outbuildings, particularly if constructed of galvanised iron, form excellent catchment areas, which should be used to the fullest possible extent for domestic use, unless as good supplies are available in a cheaper way. Because of its great usefulness in this connection a ton,

or even half a ton, of galvanised iron is a very useful and economical investment on a farm in any stage of its development in order to provide a water supply, whilst at the same time protecting the settler and his chattels from the weather. For the same reason the galvanised iron verandah surrounding the settler's bungalow homestead serves a double purpose: in addition to protecting his residence from the glare and heat of the noonday sun, it increases the quantity of water available for storage. Practically the whole of the rain falling on a galvanised roof can be conserved, so that if it be remembered that there are about six and a-quarter gallons in a cubic foot, the number of gallons available for storage can be ascertained by a simple calculation. A rough method is to estimate half a gallon per inch of rainfall for every surface foot covered by the building.

In column two of the following table will be found the number of gallons of water falling on the roof of a house covering a surface area of 30 feet by 40 feet, when the rainfall is as shown in column one. Similarly in columns three and four will be found the number of gallons falling upon outbuildings capable of being covered by one ton of iron, in column three when the roofs are gabled, and in column four when they are of the skillion type:—

GALLONS OF WATER AVAILABLE FOR STORAGE.

Rainfall in inches.	House 30 x 40	Outbuildings with gabled roofs covered by 1 ton of galvanised iron.	Outbuildings with Skillion roofs covered by 1 ton of galvanised iron.
1	625	962	1,100
2	1,250	1,925	2,200
3	1,875	2,887	3,300
4	2,500	3,850	4,400
5	3,125	4,812	5,500
6	3,750	5,775	6,600
7	4,375	6,737	7,700
8	5,000	7,700	8,800
9	5,625	8,662	9,900
10	6,250	9,625	11,000
11	6,875	10,587	12,100
12	7,500	11,550	13,200
13	8,125	12,512	14,300
14	8,750	13,475	15,400
15	9,375	14,437	16,500

Whilst the excellence of the roof supply of rain water is recognised for domestic purposes, it is doubtful whether many farmers take full advantage of it, and few indeed ever consider its possibilities as a source of supply for any of their stock. In this connection Mr. Hancock, of Belka, provided the six horses comprising his team with water from this source stored in galvanised tanks. He found that 10,000 gallons stored in this way was quite sufficient for his team throughout the season, for, in addition to starting with the tanks full at the end of the rainy season, further supplies would be obtained from showers. Incidentally it may be stated that each of the tanks used had a capacity of about 3,300 gallons, with a circumference made with 10 feet sheets of curved iron, and were eight feet high. The tanks were covered to strengthen them and to minimise evaporation. This size, and type, was adopted as the one which proved to be the largest which could be moved about with convenience.

The earthen tanks, which are the recognised economic method of conserving water for stock when a good supply from wells cannot be obtained, and which are so largely used in agricultural areas, are rectangular or square excavations with gradually sloping sides. The size ranges from a few hundred to a few thousand yards capacity, and the cost by contract ranges from 1s. 3d. per cubic yard upwards. Such excavations provide storage capacity at a fairly cheap rate, as may be seen from the following table:—

TABLE SHOWING THE ANNUAL COST OF STORING 1,000 GALLONS OF WATER IN EXCAVATED TANKS, WITH DIFFERENT RATES FOR EXCAVATION AND WITH INTEREST AT 6 PER CENT.

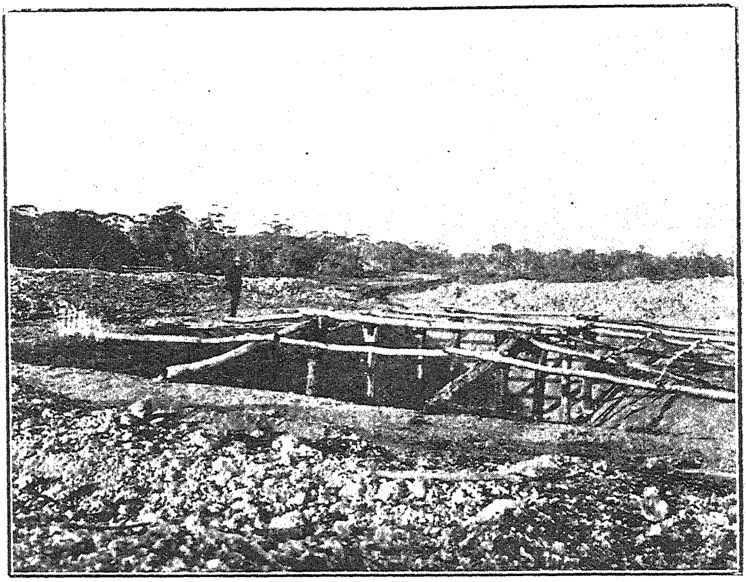
Rate per Cubic Yard.	Annual Cost per 1,000 Gallons Capacity.
s. d.	d.
1 3	5·4
1 6	6·48
1 9	7·56
2 0	8·64
2 3	9·72
2 6	10·80
2 9	11·88
3 0	12·96

It is somewhat difficult to decide what provision in the form of excavated tanks should be considered an adequate water conservation for the needs of our stock. This depends upon the character and regularity of the rainfall, and consequently the periods of scarcity for which from time to time provision may be required. During winter, and especially when there is plenty of succulent feed available, stock drink very little water, and sheep have been known to thrive for months without any at all. In dry times, however, and during hot weather, when feed is dry, the stock require a great deal; sheep will then drink about a gallon a day and horses eight to 10 gallons.

In our wheat belt there is invariably each year a period of six months during which the weather is warm and feed dry, so that it is essential to make provision for this period. Then it must be remembered that though our winter rains are very regular, many of the falls are not such as will cause water to flow into a tank from an ordinary soil catchment, and because of this it cannot be assured that the tanks supplied by such catchments will be full at the beginning of the dry period. It is therefore necessary to make provision for at least 12 months' supply of water for every head of stock it is intended to carry. For sheep, this means a provision of say, 365 gallons, or, as one cubic yard has a capacity of 168¾ gallons, of 2¼ yards effective storage. To this must be added an amount of, say, ¾ yard to cover loss by evaporation, seepage, etc., thus a minimum provision of three cubic yards for each sheep and 24 to 30 cubic yards for each head of large stock should be made. This estimation should be regarded as the margin of safety, and much greater conservation effected as opportunity occurs. In this connection it is understood that the Victorian Water Commission considers that an open storage tank of 2,500 yards capacity provides the minimum supply necessary for a farm of 700 acres, and which will carry 200 sheep, 6 cattle, and 12 horses.

A very serious feature in connection with open earthen tanks is the enormous amount of water lost from them by evaporation during our warm summer months. At the Merredin Experiment Farm the mean annual evap-

oration for the past ten years from a water surface, kept at about ground level, has been 84·778 inches. The evaporation from the usual earthen tank would not be quite as great, for the water surface would be protected to some extent by the embankments. Experience indicates, however, that it is very great, and is probably not less than six feet. With small or shallow tanks the toll is too great to be permitted. How great is the toll may be better



Framework of bush timber erected to support scrub-covered roof of excavated tank.

realised from figures relating to the calculated loss in connection with a tank 9 feet wide and 30 feet long at the bottom and 9 feet deep, with 2½ to 1 batters all round:—

	Yards.	Gallons.	%
Total capacity	607	102,431	100
Loss by evaporation	536	90,450	88
Available for consumption	71	11,981	12

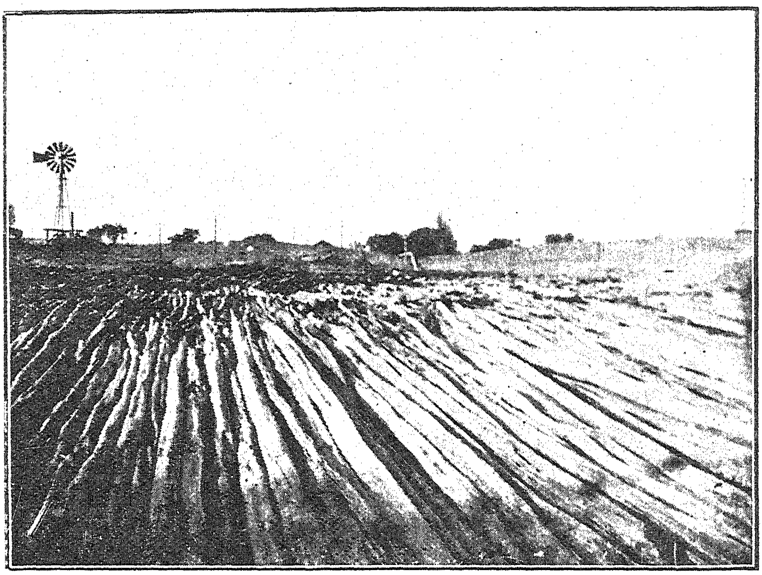
In this case only 12 per cent. of the stored water is available for consumption. With a deeper tank the percentage available is greater, but the loss is still tremendous, as may be seen from the following figures relating to a similar tank with the same dimensions at the bottom, but 16 feet deep:—

	Yards.	Gallons.	%
Total capacity	2,348	396,225	100
Loss by evaporation	1,580	266,625	67
Available for consumption	768	129.600	33

In this case the percentage available for consumption has increased from 12 to 33 per cent., due to the increase in depth. It is, therefore, obvious

that the most economical open tanks are deep ones. With very large and very deep tanks it may be cheaper to put up with this loss than to endeavour to prevent it. With small or shallow tanks this is, however, not the case, and because of this, the old shallow pothole should no longer be tolerated by any up-to-date farmer. The quantity of water which can and is evaporated by sun and wind, and which is measured by feet, not inches, soon empties a shallow tank, and makes it a mere expanse of drying mud. Water in the wheat area is too precious to be wasted by evaporation, and some effort should be made to avoid it.

Experiments in the laboratory suggested that a very thin film of oil spread over the surface would have the desired effect, but this has not proved to be the case. In the open it has been found that dust settles on the oil and causes it to sink to the bottom, or else the wind drives it to the sides where it is absorbed by the soil, and its usefulness is ended. Other methods, including the growth of aquatic plants, have been tried without success. The only satisfactory method is to roof the tank with iron, poles, brush, or straw. The settlers' usual plan is to use a cover of poles or brush supported on a framework of bush timber, as shown in the illustration. This has proved to be very effective. To facilitate the roofing of tanks they should be as narrow as it is convenient to make them. Though some evaporation is due

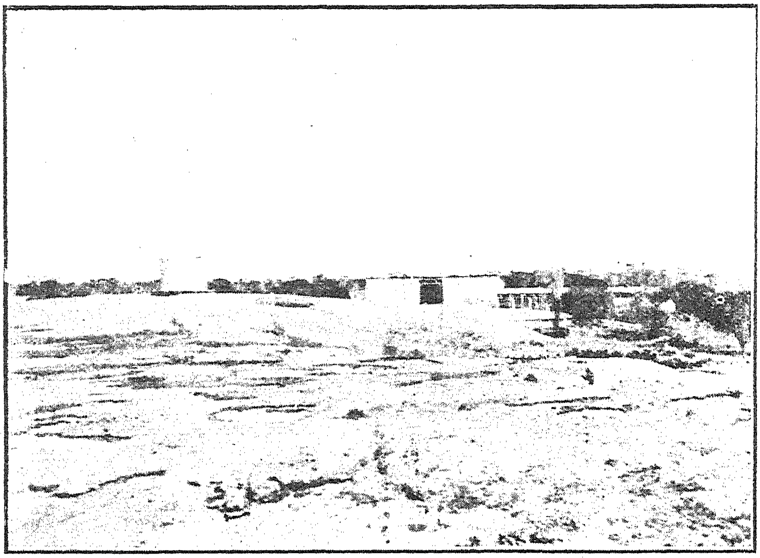


Roof of poles to reduce evaporation.

directly to the action of the rays of the sun, by far the greatest amount is caused by the wind. It is advisable, therefore, to protect the water in the tank from its effect by means of shelter belts of trees left or planted a short distance away from it.

The first essential operation in connection with the construction of these earthen reservoirs is to secure a site to which the "run off" from higher land can be conducted to them by means of drains or gutters. In undulating

country such a site can be located without difficulty, but in flat country the finding of a suitable site is much more difficult, in fact, such country often appears to the unaided eye so level that water will not run. Rarely indeed, is this the case, but it is often advisable to have some levels taken for guidance before fixing the site, for experienced men have been known to mistake the direction of the fall on such land. Very often shallow water courses exist, and these will assist in the selection of the site. If the soil holds water well, the tank should be located at or near one of these water courses. Good clay is the best material for these excavations, and on some holdings a tank will hold almost anywhere, but on others some difficulty will be experienced in securing a suitable place in which to sink the tank. It is always a good plan, before the tank is commenced, to sink several bores or trial holes to the depth it is proposed to excavate the tank, so as to determine the nature of the ground. An experienced man can tell by the nature of the subsoil whether the tank will hold. If there is any doubt on this point, the trial holes should be filled with water so that the ability of the ground to hold water can be definitely determined. A good holding clay may carry a fair percentage of grit, and each is especially good for building embankments.

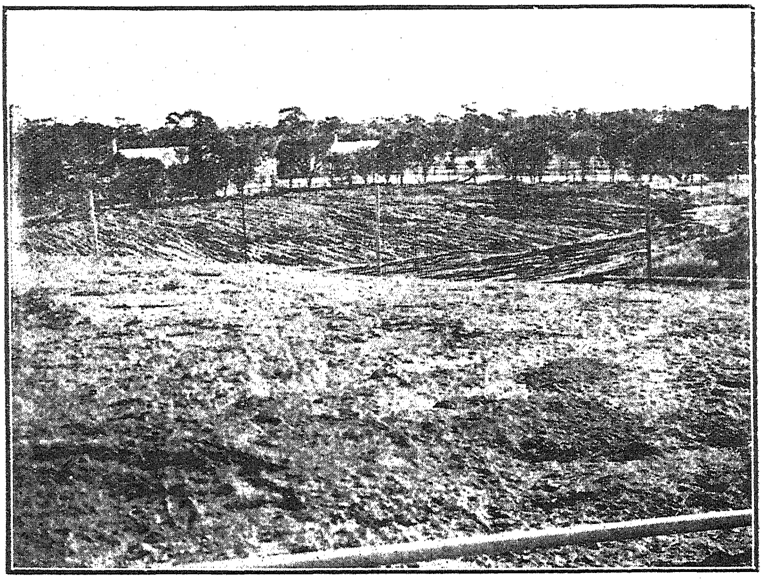


Rock catchment, Koolberin, with low gutters leading water to storage to be conserved.

A good catchment area is quite as important as the site for the tank. A tank with a capacity of 1,000 yards requires rather more than seven acre inches to fill it. The actual extent of the catchment area required will depend upon what precentage of the actual rainfall will run off to be collected. This varies according to the nature of the ground, and with the character of the rainfall. Hard compact soil is infinitely better than sand or soil which cracks when dry, and absorbs a large quantity of water before any reaches the tank. Roads make good catchments, and the water can be diverted from these towards the tank by means of shallow spoon drains which, however, when they

cross the road should extend in each direction at least one foot for every inch in depth. The natural run off of the usual soil catchment can be very much improved by any means which compacts the surface. Sheep are excellent for this purpose, and the tracks they make tend to direct the water to the drains; but cultivated lands are unsuitable catchment areas.

The best natural catchments are rock ones, and where these exist, as they do in many holdings, even light showers can be utilised to supplement the conserved supply. By building shallow gutters with rough stones along suitable contour lines the usefulness of many rock catchments can be immensely increased. This has been very successfully carried out on the rock catchments attached to the Government tanks on the Eastern Goldfields railway line, and at other places. The illustration shows work of this kind successfully carried out by Mr. W. N. Hedges, at "Koolberrin," where practically the whole of the water falling on this rock is turned to useful account, whereas without these artificial gutters quite half the water would flow in directions where it could not be stored. The low walls forming the gutters are built with irregular-shaped spawls, broken out of the scaly portion of the rock and having a rough flat base. They are placed on their base in position on the contour line marked out for them and with a slight lean outwards, and if necessary are held in position temporarily by means of a light backing of earth; they are finally pointed up on the back with cement mortar and grouted in with cement on the front.



Large "gnamma" hole, Koolberin, covered with poles to reduce loss due to evaporation.

It is as necessary to trap the water from soil catchments as on the rock ones, in the former case by means of drains dug out of the solid soil. These drains or gutters are given no more fall than is necessary for the water to run freely. The effect of this is to make the most of the catchment area available, and in the case of the drains, prevents scouring. Two inches fall to

the chain is quite sufficient, as the depth of water also gives a fall. A drain 6in. deep with a fall of 2in. to the chain would, when full, give an 8in. fall to the chain, *i.e.*, from the top of the water to the bottom of the drain.

It is not difficult to locate the position of the drains or gutters on the catchment area, it can be done readily with the aid of a straight edge and a spirit level. For this purpose the spirit level is attached to the top side of the straight edge, and at one end on the under side a piece of wood in thickness to correspond to the amount of fall desired in a distance equal to the length of the straight edge. Thus, if the fall desired is two inches to the chain, which is ample for a rock surface, and the length of the straight edge is 16 feet 6 inches, the thickness of the wood will be ½-inch, or ¼-inch if the straight edge is 8 feet 3 inches long. In operation the piece of wood on the end of the straight edge is placed on the rock or ground in the direction it is desired the water shall run, the other end is then shifted until the bulb in the spirit level assumes the level position. The straight edge is then on the line the drain should take so as to have the fall desired. The positions of the two ends should be marked by a daub of paint on the rock surface, or by a peg if in soil. After having ascertained one position in this way the next one is found by placing the lower end of the straight edge (that with the piece of wood on its under edge) on the place previously occupied by the upper end, and the first operation repeated. This is continued until the desired limits of the contouring have been reached. For this work on rocks it is desirable to have several straight edges of different lengths, some of them quite short, as the short ones are useful in places where the catchment is steep.

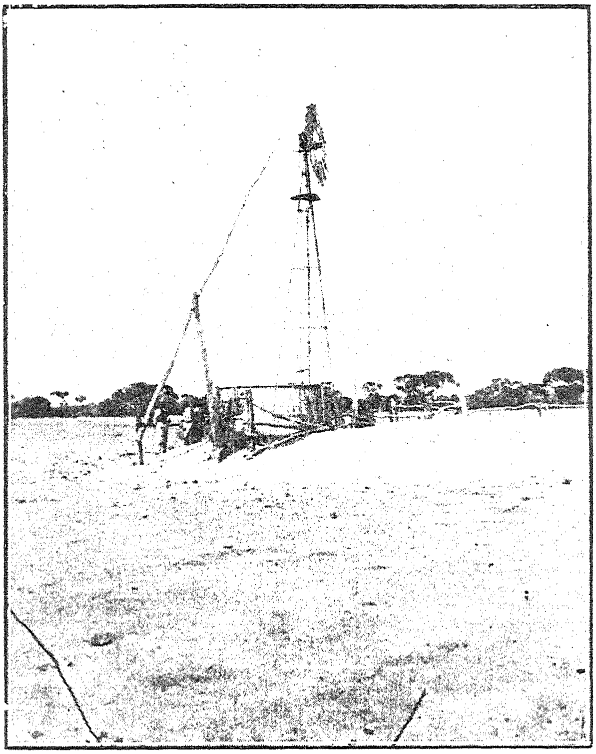
On soil catchments the levelling or "butt" peg should be driven in level with the surface, and a longer indicating peg put in alongside of it to guide the ploughman in ploughing the drains. As the "butt" peg is certain to be covered up in places, and the indicating peg will probably be knocked down, it is advisable to take two steps from the former, square off the line of drain on the down side, and put in a long peg, so that by taking two steps from this the "butt" peg can always be found even if covered up. The first furrow should be opened up on the far side of the drain, and the plough should not be run nearer than a foot or fifteen inches to the "butt" peg.

Autumn is probably the most suitable time for sinking the tank, but almost any time will serve provided the ground is not too wet, for ploughing can always be done, however dry it may be, with a proper plough and with the points of shares kept sharpened. A drain around the excavation will keep out surface water as long as provision is made for it to get away.

If the site selected contains a watercourse the tank is located preferably near, rather than on it, for when located on it there is always the risk that an unusual rush of flood water down the water course may damage the embankment, whereas if located near it the water can be diverted into the tank, and in flood time the water course itself will act as a "bye-wash" or "get-away," and the danger referred to averted. If there is a good fall on the site chosen for the tank the length of same should be at right angles to the direction of the fall and not parallel with it. If parallel with it the water in the lower end of the tank would reach the surface of the ground, when the depth at the upper end was very shallow, and thus much of its storage capacity would be lost.

Before commencing to excavate the tank a temporary drain should be ploughed out in a position that will prevent the water from running in to

the excavation from the intake to the tank. There is usually a thickness of surface soil that will not hold water, and as all tanks are required to hold water up to the level of the natural surface, and many of them above it, it is always advisable when ploughing to continue ploughing over the "cess" and for 8 or 10 feet under the seat of the embankment. All the surface soil



The ancient and modern methods of raising well water.

so ploughed is to be scooped off and deposited on the outer side of the embankment. This system has been adopted by Mr. W. N. Hedges, at Koolberrin, and the value of same is easily seen, as all the face of the embankment is built of good-holding soil, which merges on to the soil of like nature and forms a certain impervious embankment. The system of ploughing out a so-called puddle trench under the inner "toe" of embankment is useless, as, if the "cess" is not cleared of surface soil, then the surface soil from the "cess" is carried into the puddle trench by the scoop. The "cess" is the width of ground between the edge of the tank excavation and the bottom or "toe" of the embankment, and should be from 25 to 33 feet wide from the edge of the excavation to the "toe" of the inner slope of the embankment.

The excavated material should be placed neatly in the form of an embankment at the back and on the two sides. A well-built embankment, even if it does not enclose water, will protect the surface in the tank from evaporating winds. It should have four to one batters on the inside, be flat on the top, and wide enough for a horse and cart to drive on it. The slope on

the sides is known as the "batter," and its inclination is expressed by the relation which it bears in a horizontal direction to the vertical, thus a four to one batter rises one foot vertically in each four feet horizontally.

In order to offer as little surface as possible to the evaporating influences of the sun and wind it is necessary to have the sides as steep as can be managed. As these tanks are excavated with horse labour, the steepness of the batter of a tank excavation is governed by the width of the horse team. Even with horses only two abreast it is hard to get a batter less than two and a-half or three to one on the sides, nor is it advisable, as, if left too steep, it certainly will, when wet, run into the tank.

Owing to the necessity for covering tanks they should be long and narrow rather than square. The minimum width is determined by the width in which a team can work at the bottom and by the depth. The minimum working width is considered to be from six to nine feet. The dimensions and capacities of tanks which comply with this feature and with different batters are given hereunder:—

BATTERS 2½ TO 1 ON SIDES— 3 TO 1 ON ENDS.

	Feet.	Approximate Capacity. Cub. Yds.		Feet.	Approximate Capacity. Cub. Yds.
		9 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	54 x 84	666	Top	51 x 90	666
		10 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	59 x 90	848	Top	56 x 96	850
		12 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	69 x 102	1,284	Top	66 x 108	1,311
		14 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	79 x 114	1,896	Top	76 x 120	1,912
		16 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	89 x 126	2,644	Top	66 x 132	2,669

BATTERS—2½ TO 1 ALL ROUND.

		9 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	54 x 75	607	Top	51 x 81	612
		10 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	59 x 80	769	Top	56 x 86	777
		12 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	69 x 90	1,173	Top	66 x 96	1,189
		14 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	79 x 100	1,694	Top	76 x 106	1,721
		16 FEET DEEP.			
Bottom ...	9 x 30		Bottom ...	6 x 36	
Top	89 x 110	2.348	Top	86 x 116	2,387

BATTERS—3 TO 1 ALL ROUND.

	Feet.	Approximate Capacity. Cub. Yds.		Feet.	Approximate Capacity. Cub Yds.
9 Feet Deep.					
Bottom	9 x 30		Bottom	6 x 36	
Top	63 x 84	765	Top	60 x 90	774
10 Feet Deep.					
Bottom	9 x 30		Bottom	6 x 36	
Top	69 x 90	977	Top	66 x 96	991
12 Feet Deep.					
Bottom	9 x 30		Bottom	6 x 36	
Top	81 x 102	1,512	Top	78 x 108	1,536
14 Feet Deep.					
Bottom	9 x 30		Bottom	6 x 36	
Top	93 x 114	2,208	Top	90 x 120	2,246
16 Feet Deep.					
Bottom	9 x 30		Bottom	6 x 36	
Top	105 x 126	3,089	Top	102 x 132	3,143

When a surveyor's level is not available, the drains on the catchment area can be located with the aid of the straight edge and level as already described. They should be wide and shallow rather than deep and narrow, for in the former the flow is slower and there is little scouring. These drains should be cut out of the solid earth, with the soil placed on the lower side. The size of the drain should be governed by the size of the tank. Very often small drains, two or three furrows, are valuable as feeders to the main drain. Their minimum width at bottom should be one foot, with one to one batters and from nine to twelve inches deep. It is often convenient to make these drains with a quarter-yard scoop, in which case the width at bottom will be that of the scoop. Where drains curve they should be widened, the sharper the curve the greater should be the width, and when they meet the junction should be made at an acute angle. Drains should be kept clean, for unless this is done water from light showers will not reach the tank, and every shower is of importance. The subsidiary drains usually discharge into a wider main drain, but neither the subsidiary drains nor the main drain should discharge directly into the main tank. The water should first find its way into a very much smaller excavation, known as a settling or silt tank, which need not be more than five or six feet deep. This tank will prevent much rubbish and silt being carried into the main tank, and can be easily cleaned out each summer. From the silt tank the water should be conveyed to the bottom of the main tank by means of a flume, or by a wide drain which should extend to the bottom of the tank, and which should be pitched with stone to prevent erosion. This pitching is done by making an excavation the required width about eight inches deep, and filling it with large stones which are tightly wedged together by smaller ones.

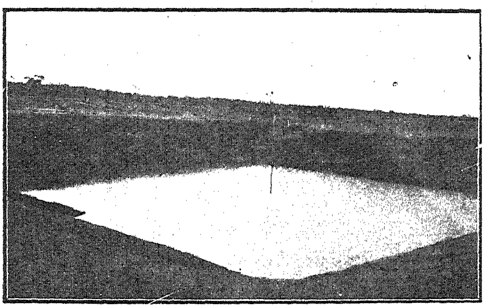
The work connected with the tank is not completed until ample provision for the overflow is made; for this purpose a large drain known as a "bye-wash" is usually provided. Even in flat country this is important, or otherwise the ends of the embankment will be gradually eroded, and the protection which it affords from evaporating winds lessened. On level ground the need for a "bye-wash" may be obviated by pitching the ends of the embankments. A "bye-wash" is, however, absolutely essential when the tank is excavated on sloping country, and where the embankment is used to conserve water above the surface of the ground, for under such circumstances, unless a "bye-wash" of ample width is made, the embankment may be damaged or even swept away, and the work of many months destroyed, and much valuable water lost, in a few minutes. The "bye-wash" is obviously placed on the lower side of the tank or dam, and, if at all possible, should divert the overflow waters into a natural water-course. It is for this latter reason that it has already been recommended that tanks on sloping-ground should be located near one of these. The "bye-wash" should leave the tank in a wide sweep, should be well clear of the end of the embankment, and of ample width. It is safer, and therefore economical, to have it several feet too wide than one foot too narrow. The top should be at least one foot below the level of the lowest part of the embankment, so that the water will be diverted before it can flow over the edge and wash the earth embankment away; it should also be excavated out of the solid earth, and where the volume of water it has to carry may be considerable, even occasionally, it is necessary to pitch the sides and also the bottom.

It is not advisable to allow stock to have access to the tank, but it should be fenced off to protect it from them as well as from vermin. The needs of the stock are best provided for by means of a pump and troughing, or, where the situation is suitable, by a syphon placed over the bank to a trough and controlled by a ball tap. These methods will prevent pollution, much water will be saved, and the efficiency of the tank will be lengthened. Even when stock are to have access to the tank it should be fenced on the three sides and down the front so as to protect the sides from being damaged by them. Whenever a tank gets low, as much silt as possible should be cleaned out, in this way the depth will be maintained and much disappointment saved. It is not unknown for a farmer at the beginning of a dry spell to find himself with a few feet of silt and several inches of water, instead of several feet of water as he expected.

The conservation of water by means of excavated earthen tanks on farms has the advantage that the farmer, by using that adaptability which he is constantly called upon to exercise, can, if he so desires, carry out the work himself. It is done with the teams he is accustomed to drive, and the work of loosening the earth with a plough, and excavating it with a scoop, is not very dissimilar to other farm operations, though it may be a little harder than some. The farmer can, therefore, provide by this method ample water conservation to meet the needs of his stock with but little out of pocket expenditure.

Conservation of water is the urgent and special need of many farmers in the Eastern agricultural areas. Not only is it the key to the greater prosperity which is possible in these areas, but it is essential for the retention of a healthy, contented and happy community. Fortunately, there is no reason

to believe that there is any district in which insufficient rain falls to provide for ample requirements, but this needs to be conserved, and it is the duty of individual farmers to see that this provision is made wherever and whenever such is possible.



THE SHEEP BLOW-FLY PEST AND ITS CONTROL.

GEO. L. SUTTON,
Director of Agriculture.

For many years there has been on the market quite a large number of simple substances and mixtures for which it is claimed that sheep will be protected from blow-fly infestation for varying periods ranging even up to six and twelve months. As the result of the investigations which were commenced in New South Wales and Queensland in 1913, and continued in co-operation with the Commonwealth Institute of Science and Industry, it was found that of all the materials tried, the one which stood out as being of any value in dealing with the pest was arsenic, and that its use in a practical way afforded a protection from injury to the extent of at least 90 per cent.

Prior to this discovery attempts were made to control or exterminate the blow-fly on sheep runs, principally by means of traps, parasites, and deterrents. None of these proved, however, after exhaustive trial, to provide sufficient protection.

Simple and cheap traps were devised and proved most effective in capturing enormous numbers of flies, but not all of them; those that remained at large proved sufficiently numerous to attack and injure large numbers of sheep. These simple traps are, however, extremely useful for minimising the blow-fly trouble around the homestead.

Several parasites were discovered and experimented with. The Entomological branches of this and other States have reared and distributed enormous numbers (running into millions) of these parasites, which must have had, and probably will continue to have, a controlling effect upon the number of blow-flies produced, but in spite of these natural enemies there are still sufficient blow-flies produced, even in districts where the parasite is native, to cause immense loss as the result of sheep being fly-blown.

Several compounds containing strong smelling substances like carbolic, creosote, etc., and which are known to be objectionable to blow-flies, have been and are being tried. These, however, have proved entirely unsatisfactory, and it is not very surprising, for the natural instinct of the female fly to preserve her species is so strong that when full of eggs or larvae she will, in the absence of carrion and in the presence of sheep, deposit them upon the latter.

Arsenic, however, provides effective protection, mainly because it acts as an internal poison both to the adult blow-fly and its larvae. To be effective it is therefore necessary to be present amongst the wool, so that when obtaining food from this source they will also obtain sufficient arsenic to poison them. This can be achieved by treating the wool with a solution of arsenic in any convenient way, such as by the usual process of "dipping" sheep. Such a plan does afford protection, as a good proprietary arsenical dip contains about .2 per cent. of arsenic in solution, and this is about twice as strong as is necessary to kill the blow-fly or its larvae. Unfortunately, however, as experience has proved, "dipping" the sheep affords protection for only a limited period of about a fortnight or three weeks, therefore, to afford such a lengthened protection as is necessary, ordinary "dipping" would require to be repeated too often to be practicable. Fortunately, it was learnt in 1916, through trials conducted at Orion Downs Station, Queensland, with Cooper's Sheep Dip, that protection for a much longer period could be obtained by using a solution of quadruple strength. To immerse sheep in such a strong solution was known to be dangerous, but as the majority of sheep are at-

tacked by the blow-fly on the breech, the strong solution was applied to that part of the wool only. It was found that this method gave at least 90 per cent. protection for a comparatively lengthy period. The method adopted at Orion Downs was then tried at the Gindie State Farm, Queensland, with similar results, and in 1918, under the co-operative scheme of investigation, it was again used at Dalmally Station and its efficiency confirmed. It was there found to be nearly perfect, the losses at Dalmally being practically nil, while serious losses occurred at certain stations in the surrounding district where the sheep had not had a strong solution of "dip" applied to the breech.

The dipping solution used so successfully contained about 0.8 per cent. of arsenic, as well as sulphur and other ingredients usually found in good sheep dips. With a view to lessening the cost of the treatment it was important to learn whether its efficiency was due to the arsenic or to one of the other ingredients, or to a combination of them. Experiments in this connection subsequently proved that the lengthened protection was due to the arsenic in the solution, and, further, that much stronger solutions containing up to 1.5 per cent. (or 15 lbs. arsenic per 100 gallons) could be used when applied to the breech, and without any ill-effect either upon the sheep or the wool. It was found, however, that a solution containing about 0.7 per cent. arsenic (7 lbs. of arsenic per 100 gallons) was quite as efficient as the higher percentages. Weekly analyses of the wool taken from the breeches of the jetted sheep showed that the amount of arsenic in same decreased from the day the sheep were treated, until at the end of three months there was insufficient left in the wool to poison the blow-fly or its larvae, even when using the largest quantity of arsenic, thus defining the period over which protection can be secured.

Since the co-operative experiments were concluded the method which gave such satisfactory results has been tried commercially in the other States as well as in our own, with equally satisfactory results. It consists of a solution containing from .5 to .7 per cent. of arsenic applied to the breech wool of the sheep, not throughout the year, but usually about a month before lambing or at any period when the blow-fly attack may be expected. This solution is made according to either of the following formulæ, which are just as effective but cheaper than sheep "dipping" powder of quadruple strength. Unless desired for other reasons it is not necessary to crutch the sheep before applying the solution.

Formula 1.	Formula 2.	Formula 3.
13½ lbs. arsenate of soda. 100 gallons water.	7 lbs. washing soda. 7 lbs. white arsenic. 100 gallons water.	3½ lbs. caustic soda. 7 lbs. white arsenic. 100 gallons water.

The white arsenic specified in the formulæ is the commercially grey arsenic which is at least 90 per cent. pure. The arsenate of soda is also the commercial article which is usually about 95 per cent. pure.

Formula No. 1 is made up by dissolving the arsenate of soda in four gallons of water, and then adding this strong solution to sufficient water to make 100 gallons.

Formulæ 2 and 3 are made up by first dissolving the washing soda or caustic soda in four gallons of boiling water, and then, whilst still boiling, adding the white arsenic and stirring. When dissolved, the solution in each case is diluted to make 100 gallons.

When compounding these formulæ care should be taken not to inhale any of the fumes or vapour rising from the boiling mixture, or the dust from the dry powder, as they are both poisonous. Care should be taken also to keep these poisonous mixtures out of the way of animals, and also label them "Poison."

As sheep are usually treated to prevent blow-fly injury when they are carrying wool of fair length, the more wool the better, and it is desirable that the solution should reach all the wool right through to the skin, the practice adopted, when large numbers of sheep are to be treated, is to use a fine jet through which the solution is driven on to the wool and right up to the skin by means of a pump working under a pressure of from 125 to 175 lbs. to the square inch. Because the solution is applied by means of a "jet," the method is known as "jetting."

At the Government Sheep Fly Experiment Station, Warrah, New South Wales, the power is supplied by a plant costing about £100. It was found that working at a pressure of 125 lbs., using a nozzle with an opening 1/16th of an inch, fitted with an "Edzell" cut-off, about 60 gallons of solution were required to jet 300 sheep, and that about 2,000 sheep could be treated by a careful man in a day of eight hours. It was also found desirable that the operator should protect himself from the solution by smearing his face and hands with some vegetable oil, such as cocoanut or castor oil, and by wearing motor goggles.

On small holdings with, say, 500 sheep or under, an expensive or elaborate plant is not necessary. The sheep, especially the ewes, which are in most danger, can be mustered periodically, crutched and swabbed with the solution of arsenic made in accordance with either of the formulæ given, or, if desired, a spraying outfit such as is used in small orchards can be used.

"Jetting" is a preventative treatment and not intended for sheep already blown; these should have the wool shorn from the affected parts, the maggots destroyed, and the wound dressed with some oil or emulsion. Kerosene, petrol, or turpentine will readily kill the maggots, but for application to the wounded surface are preferably diluted with a bland oil like sweet, olive, or castor oil; a useful oil dressing for these and wounds is made by mixing castor oil with three per cent. of carbolic acid. An emulsion which will afford protection for a more lengthy period than the applications referred to contains the following ingredients:—

1 gallon crude castor oil;	1¼ lbs. common hard soap;
1 gallon water;	2 ozs. arsenate of soda.

This is prepared as follows:—Dissolve the soap in three quarts of hot water by boiling; next dissolve the arsenate of soda in about a pint of boiling water, and add this to the hot soap solution, and make up to one gallon with water; finally add the castor oil to the hot soap mixture, and stir or agitate violently for 10 minutes. It will then form a complete emulsion ready for use, and should be applied by swabbing to the parts to be treated. It affords longer protection not because it will repel the blow-fly, but because, like the "jetting" solution, it will poison the blow-fly or its larvæ after the attack.

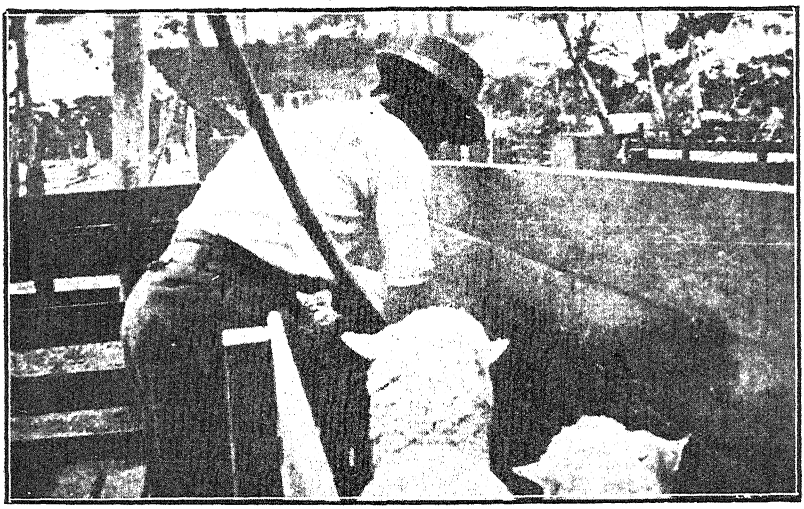
In conclusion it is emphasised that treatment with arsenic does not prevent the blow-fly from attacking the sheep, nor does it aim to do this. However, it does provide successfully a poisonous environment on those parts of the sheep most likely to be attacked, so that when the adult flies or their larvæ, dropped or produced from eggs deposited there, obtain their food, sufficient arsenic will be taken to destroy same before they can injure the sheep.

THE "JETTING" SYSTEM AT "KOOLBERIN."

W. N. HEDGES,
"Koolberin."

Prior to the installation of the jetting plant in 1913, the blow-flies caused very considerable trouble with the lambing ewes. After carefully considering the question it was decided to jet the sheep with a sheep-dip four times the usual strength in order to control the blow-fly pest. As far as the working of the system is concerned, it has proved a huge success, and since its installation there has been no trouble with blow-fly infestation.

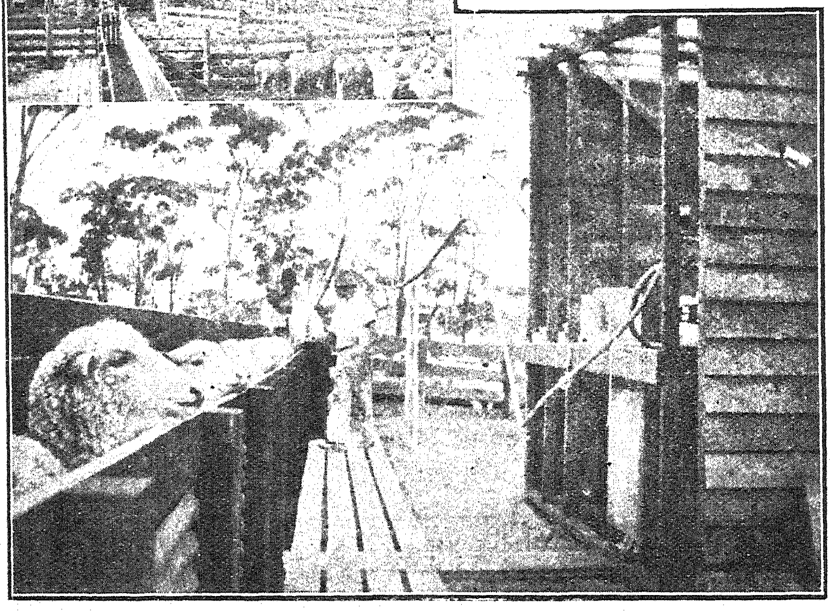
The jetting race is so constructed that the back of it is close boarded and is higher than the front. The front has a sheet of galvanised iron, with one board at the top, the iron being lapped in such a way that the wool of the sheep does not catch in the joints. The iron is used to protect the man from the spray. The details of construction may be seen from the illustration herewith.



The floor of the race on which the sheep run through is boarded with battens which are about half an inch apart, and has cross battens nailed on it. Under the race on graded boards is a tray made of galvanised iron with a three-inch fall from each end to the centre where a cross gutter is put in about 12in. wide and 3in. deep, which carries the surplus solution into a sump constructed by sinking a large cask into the ground. The tray should be hosed quite clean at mid-day and at night with the same pressure as used on the sheep. The cross drain from the race terminated about 6in. over the side of the cask, and a movable strainer is then put in so that the liquid is strained. The strainer can be lifted very quickly as it stands on two fillets. It is 12in. square with sides made of about 3in. x 1in. wood with mosquito-netting nailed underneath, and can be cleared of any *debris* which it collects by taking out and turning the bottom upwards and giving it a slight knock.

The cask is let in in such a position that the suction pipe from the engine can be dropped into it, but it has been found better to take out a few bucketsful occasionally from the cask and put it in the tank, and continue jetting from the latter. The pump is very complete with pressure gauge and also an automatic release valve, which can be set to any desired pressure. It is worked up to 175 to 200 lbs. pressure by a small petrol engine, and will work up to 300 lbs., but it was found that about 175 lbs. was ample. A Bordeaux nozzle is used.

When fixing the engine a 200-gallon tank was placed in a suitable position with a piece of 6in. x 3in. timber running along each side near the top, and projecting past the tank about 5ft. at one end and 18in. at the other where the engine is fixed. These two pieces of timber are bolted to the posts of the stand, and the ends, which project five feet, have small joists laid across them to carry the boards which form a platform just above the level of the tank. On this platform there is ample room for mixing the dip and keeping it ready for use. On the other end of the 6in. x 3in. bearers, which project 18in. beyond the tank, is bolted a piece of 10ft. x 3ft. planking, and to this the engine and pump are secured.



There are two high posts erected at each end of the race. One pair of these can be seen in the illustration. Fencing wire is run through each of these posts at a height of about 9ft. 6in., and on each wire there is a small ring about 3in. in diameter. The hose is hooked up to the rings by binding thick string round the hose forming a loop into which a wire hook connects to the rings. The inner post is in such a position that the right length of

hose is allowed to hang somewhat the same as from a shearing machine. Each post is set 12in. out of plumb against the strain. As the result of this arrangement, and as may be seen from the illustration herewith, the man using the jet has no weight on his arm, and the hose travels backwards and forwards without requiring the slightest attention.

The small crush pen at the end of the race holds just enough sheep to fill it. Battens are placed on boards in the crush pen, which is boarded so as to prevent the sheep carrying dirt with their feet into the jetting race, and the outlet end of the race is so arranged that any sheep which are found to require special attention can be drafted out. The whole lay-out has worked splendidly; the solution penetrates right into the skin of the sheep, and the average number of sheep jetted from its installation has been six per minute, including the time taken for emptying and filling the race.

There may be other systems of "spraying," and it is certain that for a larger number of sheep two races placed parallel to each other with only sufficient room between for the man to work would be advantageous, and would provide for efficient and more expeditious working. The provision of two races would enable one race to be filled whilst the sheep in the other were being "jetted," and thus a very large number of sheep could be dealt with in a day.

Since the plant was installed in 1913 there has not been the slightest alteration or addition made to it, nor has it been necessary to spend anything for maintenance or renewals. The year prior to the installation three men were continually working amongst about 700 ewes at a time when they should have been left as quiet as possible. Since that time, as the result of carefully spraying the ewes with a strong sheep-dip well up over the tail and down the breech, about three weeks before lambing, there has not been the least trouble with over 2,000 ewes lambing annually. The operation is harmless to the ewes and is very quickly carried out, as quite 4,000 to 5,000 can be sprayed in one day with only one race 60 feet long.

BLUE MOULD ON ORANGES.

W. M. CARNE, F.L.S.

The greatest cause of financial loss to the citrus industry in this State is the wastage resulting from Blue Mould. It may be safely said that Blue Mould is the factor which decides whether the exporting of oranges is profitable or not. Indeed, one may go further and say that the development of the citrus growing industry is checked more by Blue Mould than by any other factor.

It must be again emphasised that Blue Mould follows injury to the skin of the orange. Careful handling, the packing of dry fruit, and its dry storage when packed are the principal means of reducing Blue Mould wastage. There are, however, factors which render difficult the attainment of these ideals. Firstly, our oranges are picked during the wet season, and proper sweating in the packing sheds is frequently difficult if not impossible. Wastage increases rapidly under moist conditions, for slight injuries, which might escape infection under dry conditions, are readily infected when the conditions are moist. Secondly, owing to the limited number of ships and the uncertainty of their arrival packing of large consignments for export must be commenced weeks before shipment, or be rushed through in a few days. In the former case wastage often sets in before the fruit leaves the orchard, and in the latter there may not be time for sweating, and there is a strong tendency for rough and careless handling. Lastly, and probably the most important point of all, is the fact that oranges grown on the coastal plain develop a fine delicate skin. Experience has shown their great liability to injury and mould. Oranges from the Darling Ranges have coarser skins and richer colour and are less liable to this wastage. This variation of the fruit from different districts is not peculiar to this State, but has been noted in South Africa and the United States.

The following notes on Blue Mould wastage in Florida have been taken from a bulletin published by the United States Department of Agriculture. They show how the problem has been solved in Florida, and confirm the fact that a sound, clean, unbruised skin will effectively protect an orange from Blue Mould:—

Excerpts from Bulletin of U.S. Department of Agriculture.

FACTORS GOVERNING THE SUCCESSFUL SHIPMENT OF ORANGES FROM FLORIDA.

Keeping Quality of Florida Oranges.

The keeping quality of the orange is naturally good. Since the life processes of the fruit continue after it has been severed from the branch, there is a prolonged period during which an uninjured orange remains sound and free from all decay. Ultimately, when the life span has been run, the tissues die and decay follows even in uninjured fruits. The delay is long enough, however, to allow the average fruit to be packed and placed on the market and to reach the consumer in sound condition.

Heavy Losses from Decay in Commercial Shipments.

The losses from decay during transit have been very heavy in the commercial shipments of fruit, and the experimental work of the Bureau of Plant Industry was undertaken in Florida in response to the many requests for advice and assistance which came to the Department of Agriculture. It is difficult

to estimate what the actual loss from this cause has been during past seasons. Several reliable commission men who handle large quantities of Florida oranges each year have stated that averaging the good with the bad years probably 10 per cent. of the fruit decayed before reaching the consumer. Experimental shipments made under the direction of this Bureau indicate that the loss may have been fully as heavy as this.

Since Florida's orange crop averages 4,000,000 or 5,000,000 boxes per year, the decay of 8 or 10 per cent. of this fruit entails an annual financial loss of at least half a million dollars. Ten per cent. of 4,000,000 boxes amounts to 400,000 boxes, on which the picking and packing charges have been paid, with approximately 50,000 dollars spent for box material alone. The freight charges represent something like 200,000 dollars, and these amounts, together with the cost of repacking what is left, bring the total loss high enough to seriously endanger the welfare of the industry.

Reputation Injured by Decay in Transit.

Unfortunately the financial injury is not confined to the fruit actually decayed. It is impossible to estimate the loss which has resulted to the industry from the bad reputation which Florida fruits have gained in trade. While it is difficult to discover how far the low prices occasionally received have been due to this cause, many fruit handlers in Northern markets condemn very strongly the poor keeping quality of the Florida orange and willingly admit their intention of using fruit of better keeping quality if they can obtain such from other points. The situation of the Florida orange grower would be critical indeed if it were not for the fact that fruit handled carefully shows so much less decay than does fruit picked and packed under careless commercial conditions.

History of the Department Work in Florida.

Investigations by the Department of Agriculture, having in view the discovery of the factors underlying the successful shipment of oranges from Florida to northern markets, began during the season of 1907. The work, which was planned along lines similar to those followed in the California investigations, included the determination of the character and type of handling employed in the various operations of preparing fruit for shipment and the discovery of the relationship between present methods and the occurrence of decay. The object of the work of the department was to suggest changes in the industry which should reduce the immense annual financial losses of the Florida growers by enabling them to market their fruit in sound condition.

The first researches in Florida were conducted by Mr. L. S. Tenny, who devoted his attention to an inspection of the work done by various picking crews and individual pickers, as well as to the character of work being done in the packing houses. It required only a short time to indicate that what had previously been found to be the case in California was also true in Florida, viz., that the fruit was receiving considerable injury in the course of its preparation for shipment. Conditions were, if anything, somewhat more exaggerated, owing to the fact that the thin-skinned, juicy Florida orange is of a more tender type and is more easily injured, and the bulk of the handling which would enable Californian oranges to go through the various picking and packing operations without injury is not safe for the Florida product. The importance of avoiding dropping or puncturing by long stems is most urgent when dealing with thin-skinned, juicy fruit. The necessity of handling with extreme care so perishable a product as the Florida orange cannot be too strongly emphasised.

After the determination of the character of work being done and the discovery that considerable injury was being inflicted on Florida fruit, the investigations were so planned as to determine whether it was practicable to handle the fruit with sufficient care to prevent injury. At first demonstrations corresponding to those carried on in California were made in the packing houses, using fruit selected for soundness and similar lots showing injuries of various kinds. The effects of dropping the fruit and of washing it to remove sooty mold, were also demonstrated. These lines of work prove conclusively that Blue Mold develops wherever the skin of the orange is injured in any way, and that dropping is followed by serious decay, especially when the fruit

falls into a receptacle containing dry twigs, gravel, splinters, or other matter rough enough to bruise or puncture the skin.

After the packing house demonstrations, showing that sound, uninjured Florida oranges are not affected with Blue Mould decay, shipping experiments under commercial conditions were undertaken. These experiments consisted of forwarding boxes of fruit of known history to Washington, where the percentages of decay were carefully determined on the day of arrival and after one, two and three weeks, the fruit meantime being held under ordinary open market conditions.

These experiments were followed during five successive seasons, thus enabling the investigators to determine the effect of seasonal influences. The data obtained during 1910-11 and 1911-12, when the work was undertaken on a more extensive scale than in the former seasons, corroborated the early results without exception, and the carrying quality of the Florida orange when packed and shipped in sound condition was proved to be as good as that of the California product. An injured orange, whether grown in California or in Florida, will decay whenever the conditions for the development of Blue Mold are favourable. A sound orange in good, healthy condition, whether grown in California or in Florida, is able to resist Blue Mold decay.

Blue Mold Decay of the Orange.

Indications of decay—the characteristic appearance of the orange decayed by Blue Mold—is too well known to need description. Every handler of citrus fruits knows Blue Mold, which is by far the most common form of decay. The grower frequently sees it in the oranges hanging upon the trees, when the fruit has split or has been injured by thorns or twigs. He finds it in the fruit which has dropped to the ground. The packer sees it in the cull pile or in the boxes of fruit left standing in the house for a few days. The receiver of the fruit finds the decay as the boxes are opened, and frequently he smells it before removing the covers.

The first indication of decay is a small area of soft tissue at some point on the surface of the fruit. This increases rapidly in extent if the weather is moist and warm, and within a day or two a bluish or greenish spot develops. If weather conditions continue favourable, the entire fruit is rotted within a few days and the surface is generally coated with a bluish or greenish blue mat or powdery covering.

Blue Mold Fungus.

Blue Mold decay is caused by the growth of a minute organism within the tissues of the fruit. Laboratory experiments have shown this organism to be a fungus of the genus Penicillium, which includes the familiar blue mold or mildew on bread, on the surface of canned fruit, and on other vegetable matter. Growth takes place within the orange, the bluish mat on the skin being composed of the fruiting bodies made up by chains of spores, massed together in great numbers. The fungus is spread by means of these spores, which, like the seeds of many higher plants, germinate and grow as soon as they find lodgment under conditions favourable for their development. They require heat and moisture, and when these are present growth proceeds at a very rapid rate. The Blue Mold fungus has not the power to penetrate the sound living tissue of a well-grown fruit: hence, there must be a break or an abrasion of some kind in the skin, through which the disease may find an entrance. When growth has once started, even in a small way, the fungus is capable of killing the surrounding tissues and thus producing material on which to grow. This process continues until the entire fruit is destroyed. If, therefore, a fungus spore is present and lodges in an injured spot, the initial step toward decay has been taken, and if the temperature and moisture conditions during the next few days are favourable, the development of the fungus proceeds rapidly and the orange is almost sure to rot. Many experiments have been made in California and Florida packing houses in placing spores on fresh injuries, and, without exception, the characteristic decay has resulted. On the other hand, large quantities of fruit have been held under weather conditions most favourable to the development of decay, and the results prove that fruit which has been so carefully handled as to preserve the skin in an uninjured condition

shows practically no decay even when the surface has been purposely covered with spores. The development of decay is most rapid during warm, moist weather: fruit packed during a cool, dry period frequently reaching the market without much waste even though injuries are present. Under changed atmospheric conditions, the same fruit may arrive in a badly decayed condition. During an average Florida winter there are usually periodical warm spells. Reports of general heavy decay at the market end can almost without exception be traced to fruit packed and shipped during these warm periods.

With this understanding of the nature and cause of the most common form of decay, it becomes easy to see how the harvesting and handling methods may have an important bearing on the keeping quality of the fruit. If these are such as to break the skin or injure the orange, even slightly, favourable conditions for the development of Blue Mold decay exist, and such decay is almost certain to result, as observations have shown that the spores of the Blue Mold are present practically everywhere. It is safe to say that most of the decay occurring in Florida oranges while in transit is due to Blue Mold. There is some loss in transit from decay due to other forms of rot, and this is usually very slight as compared with the loss from Blue Mold.

Causes of Blue Mold Decay.

Since the principal means of securing oranges of good keeping quality is by eliminating mechanical injuries to the fruit, and occurrence of decay is, therefore, closely connected with the handling methods in use in the grove and packing house.

Thorn punctures, which are made while the fruit is still on the tree, are among the first injuries to which citrus fruits are subjected. These are generally unavoidable, as during every wind storm a certain percentage of the fruit is injured by being blown against thorns. The puncturing which occurs when the fruit is being picked may be prevented, however, although it is frequently difficult to handle the oranges with sufficient care to avoid pressure against thorns or dried twigs when these are present in large numbers. Fruit is often bruised when the ladder is placed carelessly in the tree or when the sack is allowed to strike, or is pressed against the branches or ladder. Moreover, filling the field boxes so high that the fruit projects above the top will result in crushing the oranges when the boxes are stacked one on top of another. The oranges may be bruised on their way from the grove to the packing house by being jolted over rough roads in springless wagons. The driver of each wagon should be given a specially prepared seat and not allowed to sit upon the fruit.

Among the most common forms of injury may be mentioned scratches made by the finger-nails of the pickers and packers, each of whom should be required to wear gloves. It is comparatively easy for packers, especially if their finger-nails are long, to seriously injure a large percentage of the oranges which they handle. Some packers also do a great deal of harm by dragging the oranges around in the bins and by tossing the off sizes into the neighbouring bins. Abrasions due to the presence of gravel, twigs, splinters, protruding nails, or other foreign matter in the picking receptacles, field boxes, or packing bins may have far-reaching consequences.

Bruises caused by dropping the fruit in the various stages of picking or packing have been found to cause serious loss from decay. There are a number of places where oranges may be greatly damaged by dropping. First of all, the picker may toss them carelessly into his picking basket or bag. Careless pickers frequently throw the oranges into the open receptacle by means of a shove with the clippers, the fruit sometimes falling as far as three or four feet. Serious damage may also result from emptying the fruit roughly into the field box. The bag or basket may be held too far above the box and the fruit allowed to fall too great a distance. In case the bottom of the box is covered with twigs or small pieces of dirt the injury is greater. A sack which opens only at the top and from which the fruit must be poured into the boxes is likely to cause severe damage because of the bumps to which the fruit is subjected. Usually no greater care is observed when emptying the fruit into the field box and from that into the hopper of the washer, grader or sizing machine. The washing machine provides excellent opportunities for the infliction of mechanical injuries and for infection from dirty water. Ths phase of the subject will be discussed later.

Decayed fruit and trash should not be left in the boxes or allowed to accumulate on the floor and under the packing bins. The slightest breeze will scatter great quantities of blue mold spores from these rotted oranges over all the fruits in the house. A clean, well lighted packing house greatly diminishes decay by reducing the chances of infection. It has a beneficial influence on the workmen as well, offering a great incentive to better work. Moreover, a clean packing house is a good indication of the character of work being done throughout and indicates whether genuine efforts are being made to improve the methods of handling.

The hopper into which the fruit is emptied has always been the source of much injury to citrus fruits in Florida. In the old style of packing house, existing before the work of the Bureau of Plant Industry was begun, the hopper was frequently large enough to hold a wagon-load of fruit. Few, if any, of these are now in use. Even the more desirable small hopper was constructed with such a steep gravity run that the fruit was subjected to a severe bump on reaching the bottom. In going through the machinery or over the grading table other chances for injury occurred, and the final drop into the packing bin was sure to add several bruises. The desirable hopper has padded sides and allows the fruit to be emptied gradually by means of moving belts, which carry the fruit to the washing machine or grading belt: it is not necessary for the fruit to fall by gravity at any stage of its journey.

The most serious form of injury, however, is made by the clippers in removing the fruit from the tree. These clipper cuts are not as prevalent in Florida oranges as was found to be the case in the Californian fruit, for the reason that the Florida oranges are round and do not have the depression at the stem end which exists in the Washington Navel. Nevertheless, enormous damage has been done to the Florida fruits either by cutting the skin near the stem end when severing them from the branch or by puncturing them with the points. It is essential to have the ends of the clippers rounded or blunted in order to eliminate the possibility of piercing the fruit.

The presence of long stems on the oranges may be reckoned as equally disastrous. For this reason, in determining the character of work being done by a picking crew or individual picker, long stems are included as imperfections. A long stem is just as serious, if not more dangerous, than an orange which has been injured in some way; the latter decays, but this rot seldom affects a neighbouring orange; whereas a long stem has ample opportunity to injure a number of fruits in their progress from the tree to the packing bax. A sharp ragged fragment of stem projecting from the orange will injure all the fruit with which it comes in contact in the picking bag, field box, brusher, washer or packing bin. When it is considered that long stems are probably the most common imperfections found in the work of the Florida crews, the importance of giving particular attention to the picking becomes apparent. In most instances it is impossible to avoid leaving long stems, unless the so-called double cut is made. This means that the fruit is first severed from the tree with a stem half an inch long which is trimmed off when the fruit is held in the hands of the picker. This enables the workman to cut closely and carefully without danger of clipper cutting, and at the same time it prevents him from throwing or "shooting" the fruit into the picking receptacle. Actual experience shows that it requires very little more time to make the double cut, and when the picker becomes accustomed to clipping in this way he can operate practically as fast as with the old method, where he has to use care to prevent clipper cutting. Of course, it takes longer to make a careful double cut than to pay not the slightest attention to the character of the work performed. Since the picker is frequently unable to see the stem when the orange is on the tree, he consumes much time in adjusting his clippers in the right position. In making the double cut he is not concerned with the placing of his clippers, simply reaching out and severing the orange with a stem long enough to avoid contact between the fruit and the clippers; then when he holds it in plain sight he can easily make a smooth, close cut.

Evolution of the Florida Citrus Industry.

The results of the bureau investigations emphasise the importance of having the fruit arrive in market in good condition and of having it remain sound while in the hands of the wholesale and retail dealers. Shippers are frequently of the opinion that their interest in the condition of the fruit does

not extend beyond the percentages of decay found on arrival. It is realised that buyers can claim allowance for such decay, and consequently shippers are usually anxious to prevent it. In their opinion any decay which results after the fruit is purchased is the buyer's loss. This impression is erroneous, for the decay which develops after the fruit is in market is just as direct a loss to the growers and shippers as that which appears during transit. Although the direct shipper does not have to make a cash allowance for decay, occurring during the market holding period, brands which fail to remain in good condition lose their reputation and ordinarily do not command as high prices as do those which are known for their good market-holding quality. The wholesale and retail merchants want oranges upon which they can depend to remain in sound condition. For such fruit they are willing to pay a premium, while fruit which develops a high percentage of decay before it can be sold has nothing but its cheapness to recommend it. A grower or shipper who consigns carelessly or poorly packed fruit with the expectation that it will remain sound until it gets into market deceives no one but himself. He may be able to dispose of a few cars at fair prices, but the buyers soon learn what to expect and prices fall accordingly. Fruit which develops a high percentage of decay while in the market is the poorest kind of an advertisement, not only for the brand under which it is packed but also for the section of the State from which it is shipped.

In many cases growers and packers are anxious to do careful work, but they do not realise how many factors there are in the handling operations which may cause injury and therefore decay. They do not appreciate what careful handling means and they under-estimate its importance until the results are demonstrated to them. Injuries causing decay in citrus fruits while in transit and in market may occur from operations through which the fruit is put from the time it is taken from the tree until it is placed in the packing box. It is the prevention of these injuries in grove and packing house that makes up careful handling, and both grower and packer are concerned in knowing how they are caused and how they may be eliminated.

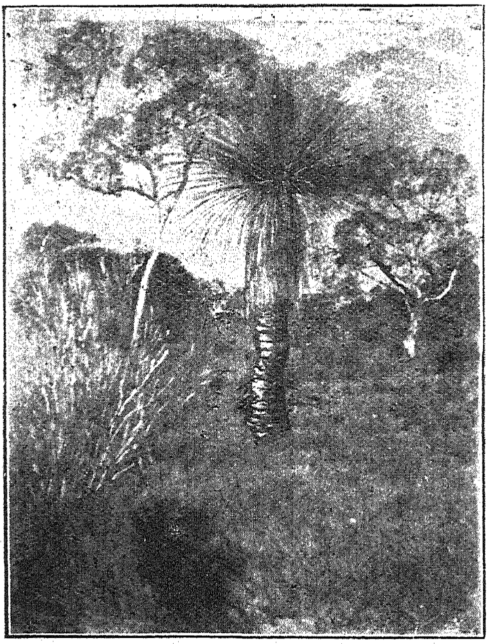
At the time the Department investigations were started the methods of handling Florida citrus fruits for shipment were extremely crude. Growers did their own picking, there was no uniformity of system, and the work was performed only indifferently well. These statements are not meant to reflect in any way upon the standing of the industry or to criticise the individuals who were concerned with the preparation of the fruit for market. Practically all of the imperfections were due to a lack of knowledge on the part of the growers and shippers and not to their desire to slight any of the important work. No one realised the effects of injury to the fruit, and few, if any, believed that injury was being inflicted. Growers and packers frequently greeted the Department workers with the statement that practically no injury was being done to their fruit, whereas later examination often showed 15 or 20 per cent. of their oranges to be injured in some way. The scattered nature of the industry was largely responsible for the crudeness with which the work was carried on. The old neighbourhood competition in the production of high-grade, attractive fruit, disappeared after the freeze, when the plantings were distributed so widely over central and southern Florida. Groves were more or less isolated, and a grower was frequently wholly ignorant of the type of work being done by other producers of citrus fruits.

When the department investigations were begun it seemed almost hopeless to expect that the results of the work could be made effective. The importance of getting in touch with every grower and shipper was realised from the start, yet without some central organisation through which these individuals could be reached, it seemed impossible to expect that improvements in the methods of handling could be inaugurated.

The changes which have taken place in Florida during the past five years are truly remarkable. The old type of packing house has almost entirely disappeared. Modern houses, equipped with the newest machinery for handling fruit properly, have been constructed in practically every citrus district in the State, so that at the present time the industry is practically well provided with the mechanical appliances for doing good work. The attitude of the growers and packers has changed more slowly, however. The Department has conducted a large number of field demonstrations in order to educate pickers to the necessity of careful work, and although much has been accomplished in this line,

much still remains to be done. The introduction of better handling methods is largely a business problem. It has to do with the re-organisation of the forces of workmen and with the method of paying them rather than with discovery of the cause of a particular form of decay.

In California the occurrence of injury in preparing the fruit for shipment was associated with the way in which the work was done. The pickers were paid by the box, and naturally each man was ambitious to pick as many boxes as possible during the day, irrespective of the character of his work. A premium was thus placed on rough handling. Several large companies, employing hundreds of men, demonstrated that by changing from the box-payment to the day-payment plan and by insisting upon careful work they could practically eliminate all picking injuries. A change in the plan of payment is not, in itself, sufficient to bring about better work, however; the workmen must be properly organised and supervised, and each individual picker must be held responsible for the character of his work. In California change from the individual grower doing his own picking to the plan of the Association picking crews, resulted in very great improvement in the character of the work. The same plan has more recently been carried out in Florida with very beneficial results.



WHEAT EXPERIMENTS AT THE CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

DEPTH OF PLOUGHING EXPERIMENT.

The soil on which this experiment was carried out was of a red sandy loam from which jam and wattle trees had been cleared some years previously.

The plots were ploughed with a mouldboard plough to depth required for the experiment early in August, and were cultivated with a "Springtyne" during spring and again prior to planting, and they were in splendid order when planted.

The seasonal rains commenced on 11th May, and the plots were planted on 13th May with "Nabawa" at the rate of 45 lbs. seed per acre, with an application of 90 lbs. of superphosphate (22 per cent.) per acre.

The area of each plot was half an acre, one-eighth being cut for hay and three-eighths left for grain.

The results obtained this year, together with the average yields to date, are shown in the tables hereunder. Before the plots reserved for grain could be harvested they were destroyed by fire, and no results were therefore obtained. The average yields obtained in previous trials are, therefore, shown:—

DEPTH OF PLOUGHING EXPERIMENT.

CHAPMAN EXPERIMENT FARM—1924

Variety, Nabawa. Planted May 13th. Seed, 45lbs. Superphosphate, 90lbs.

HAY YIELDS.

Depth of Ploughing.	Computed yield per acre.	Percentage yield.	Average yield to date, 1914-1924 (11 years).	Percentage yield 1914/1924 (11 years).
	cwts. qrs. lbs.		cwts. qrs. lbs.	
4in.	33 1 20	97	25 0 11	100
6in.	34 1 12	100	25 0 4	100
8in.	37 1 4	109	26 1 22	106

GRAIN YIELDS.

Depth of Ploughing.	Average yield 1915-1923 (9 years).	Percentage yield, 1915-1923, (9 years).
	Bushels lbs.	
4in.	15 45	101
6in.	15 52	100
8in.	16 33	107

It will be seen by the above tables that the results of this year confirm those obtained in previous years, namely, that although the increase due to the deeper ploughing is not great it tends to improve the yield on the lighter soil rather than decrease it.

WHEAT VARIETY TRIAL.

This experiment was carried out on one of the first fields cleared on the farm. The soil was a light sandy loam, and is what may be described as fair quality "Jam" land.

The ground was prepared for this planting by being ploughed 4 inches deep during August, cultivated with the "Springtyne" cultivator during October, and again in March prior to seeding. It was then in good condition.

There were 11 varieties under trial, the variety "Gluyas Early" being used as the control. The seeding was done during the third week in May. The rate of seeding for the various varieties was 45 lbs. per acre, and superphosphate (22 per cent.) was applied at the rate of 90 lbs. per acre.

The area of each plot was 1/8 of an acre, each plot being repeated eight times, three being harvested for hay and five for grain. The hay plots were harvested during the last week in September, and the grain plots during the last week in November.

The results obtained for this year, together with the percentage results of last year, are shown in the tables hereunder:

CHAPMAN EXPERIMENT FARM.

VARIETY TRIALS—1924.

Planted May 18, 19, 20. Seed, 45lbs. Superphosphate (22%) 90lbs.

HAY YIELDS.

Variety.	Computed Yield per Acre.									Average, 1924.			Percentage. 1924.	Percentage. 1923.
	Section 1.			Section 2.			Section 3.							
	cwts.	qr.	lbs.	cwts	qr.	lbs.	cwt.	qrs.	lbs.	cwts.	qr.	lbs.		
Gluyas Early ...	39	1	4	42	1	4	33	2	16	38	1	20	100	100
Nabawa	23	2	0	24	0	16	21	1	12	23	0	0	60	87
Yandilla King ...	23	0	24	22	1	20	20	0	0	21	3	12	56	96
Nungarin ...	36	2	0	39	2	24	25	1	20	33	3	12	88	...
Dindiloa	36	2	24	39	3	4	25	3	12	34	0	16	88	82
Gluyas Early ...	41	2	16	43	2	8	30	3	12	38	2	24	100	100
Gresley	44	0	16	39	1	4	30	2	24	38	0	8	100	103
Comeback ...	43	0	8	34	0	0	31	0	24	36	0	8	96	86
Toby's Tusk ...	43	0	24	36	1	4	33	0	8	37	2	0	101	84
Merredin ...	44	2	8	33	2	24	29	1	20	35	3	20	98	88
Gluyas Early ...	43	2	24	33	0	16	31	1	12	36	0	8	100	100
S. H. J. ...	45	0	0	26	1	4	32	1	4	34	2	0	95	83
Florence	39	3	12	25	2	24	32	2	24	32	3	4	89	78
Gluyas Early ...	42	3	12	30	0	0	38	2	24	37	0	24	100	100

GRAIN YIELDS.

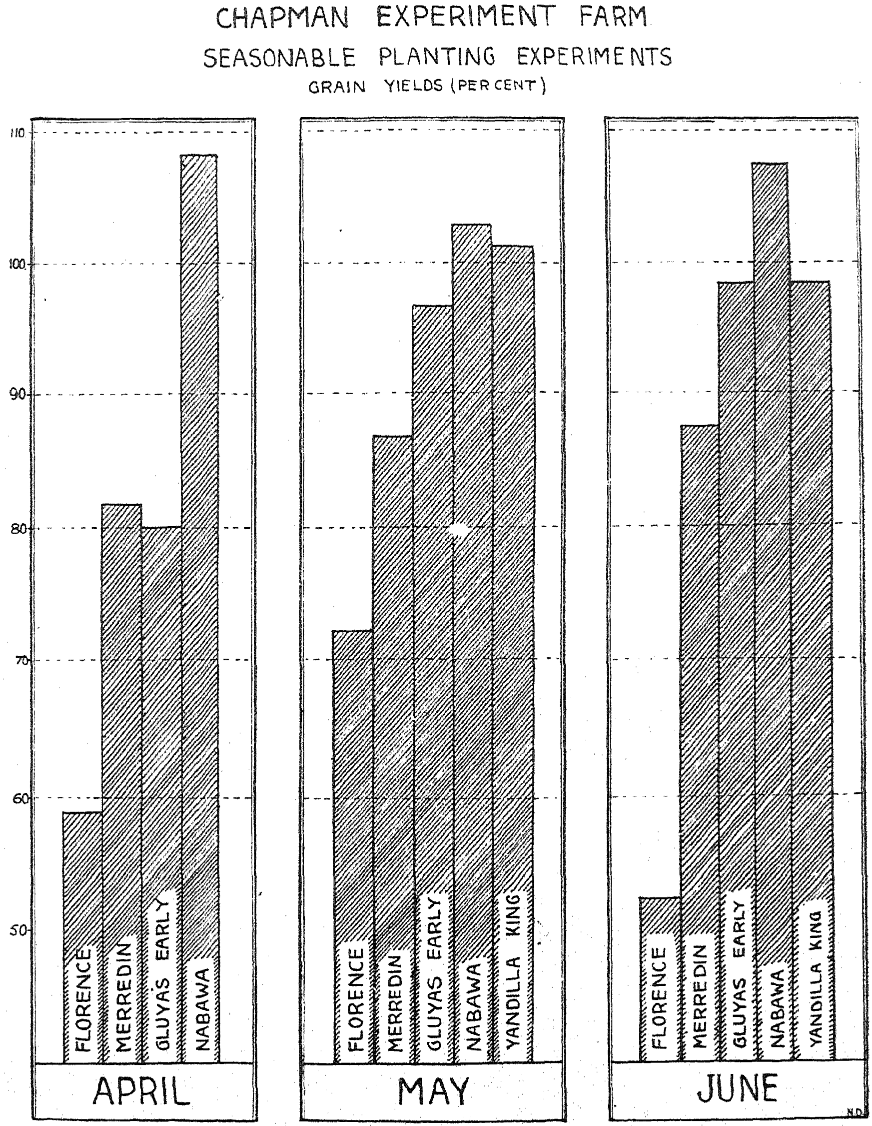
Variety.	Computed Yield per Acre.										Average. 1924.		Per-centage. 1924.	Per-centage. 1923.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		
Gluyas Early ...	15	4	14	56	14	48	16	32	16	40	15	36	100	100
Nabawa	14	16	17	36	16	40	17	44	19	44	17	12	108	103
Yandilla King ...	12	40	14	16	14	48	14	0	14	56	14	8	87	105
Nungarin	16	0	16	16	16	8	16	8	16	24	16	8	98	...
Dindiloa	16	48	18	24	18	0	19	12	20	40	18	40	111	100
Gluyas Early ...	14	0	16	40	16	24	18	8	20	48	17	12	100	100
Gresley	15	20	18	16	18	40	19	4	22	8	18	40	108	118
Comeback ...	14	24	15	52	16	32	16	24	19	36	16	32	95	90
Toby's Tusk ...	16	32	17	12	18	24	19	52	21	44	18	48	107	102
Merredin	18	48	19	52	19	44	21	4	24	0	20	40	117	110
Gluyas Early ...	15	36	16	40	17	28	18	0	21	20	17	52	100	100
S. H. J.	16	8	16	32	16	40	17	28	18	16	17	4	96	86
Florence	12	32	12	48	13	36	13	52	16	24	13	52	77	76
Gluyas Early ...	17	12	16	56	17	4	19	44	19	44	18	8	100	100

This experiment has not been conducted long enough for reliable conclusions to be made, and in making comparisons of the yields obtained it is important to remember that the past season was an unusually late one, with good harvest rains after the middle of October, whilst in 1923 the harvest rains practically ended in September.

SEASONABLE PLANTING EXPERIMENT.

For some years past single row tests have been made to determine the most suitable time for planting the different varieties which vary with regard to their periods of maturity.

Observations indicated that these single row tests were not likely to give as reliable results as those obtained with field trials, and therefore it was decided to carry out, during the past season, a field trial with four varieties each representing a class with a different period of maturity. "Yandilla King" was chosen to represent the late maturing, "Nabawa" the midseason, "Gluyas Early" the early, and "Florence" the very early varieties. For control purposes the variety "Gluyas Early," planted in May, was used.



In the April and June plantings the varieties were planted in sections, with the control plots as the first and last of each section of six plots. Each plot was one drill width and one-eighth of an acre in area. Each section was repeated eight times, three being harvested for hay and five for grain.

The land on which the different plantings were situated was of a sandy loam typical of the Jam country. It had been prepared by ploughing 4in. deep during late July and early August, and cultivated with the "Spring-tyne" cultivator during spring and summer, and again prior to each planting. The control plots in the early planting in this way received an extra cultivation, as also did the plots planted in June after the control plots had been planted in May.

The rate of seeding in all cases was 45 lbs. per acre, and the superphosphate (22 per cent.) was applied at the rate of 90 lbs. per acre.

The results obtained are:

CHAPMAN EXPERIMENT FARM.

SEASONABLE PLANTING EXPERIMENT.

APRIL PLANTING.

Planted April 21, 1924. Seed 45lbs. Superphosphate (22 per cent.), 90lbs.

HAY YIELDS.

Date of Planting.	Variety.	Computed Yield per acre.									Average Yield, 1924.		
		Sec. 1.			Sec. 2.			Sec. 3.					
		cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.
May 20	Gluyas Early ...	30	0	16	36	2	0	42	0	8	36	0	27
April 21	Nabawa	27	1	4	34	2	16	49	0	0	37	0	0
April 21	Yandilla King ...	15	1	4	17	2	8	31	2	16	21	2	0
April 21	Gluyas Early ...	32	2	8	30	0	8	42	3	12	35	0	16
April 21	Florence	23	3	20	33	3	20	38	0	8	32	0	0
May 20	Gluyas Early ...	35	1	4	34	1	4	35	2	0	35	0	3

GRAIN YIELDS.

Date of Planting.	Variety.	Computed Yield per acre.										Average Yield, 1924.	
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.			
		bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
May 20	Gluyas Early ...	17	4	18	32	18	40	19	20	18	40	18	27
Apl. 21	Nabawa	20	16	18	16	18	32	17	4	17	44	18	24
Apl. 21	Yandilla King ...	11	12	9	44	11	12	8	24	10	16	10	8
Apl. 21	Gluyas Early ...	15	52	16	32	14	24	16	8	17	20	16	0
Apl. 21	Florence	12	16	12	24	12	32	14	24	14	16	13	12
May 20	Gluyas Early ...	18	32	18	16	17	44	19	20	17	52	18	21

CHAPMAN EXPERIMENT FARM.
SEASONABLE PLANTING EXPERIMENT.
JUNE PLANTING.

Planted June 18. Seed 45lbs. Superphosphate (22 per cent.) 90lbs.

HAY YIELDS.

Date of Planting.	Variety.	Computed Yield per acre. Sec. 1.			Sec. 2.			Sec. 3.			Average Yield, 1924.		
		ct.	qr.	lbs.	ct.	qr.	lbs.	ct.	qr.	lbs.	ct.	qr.	lbs.
May 20	Gluyas Early ...	35	1	20	39	2	16	30	0	8	35	0	8
June 18	Nabawa	18	2	24	15	0	16	18	2	24	17	2	0
	Yandilla King ...	19	3	20	18	3	12	20	1	20	19	2	24
	Gluyas Early ...	23	3	4	21	1	12	21	3	12	22	1	12
	Florence	15	1	20	17	0	24	16	1	20	16	1	12
May 20	Gluyas Early ...	37	2	24	37	2	8	39	3	20	38	1	20

GRAIN YIELDS.

Date of Planting.	Variety.	Computed Yield per acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Average Yield, 1924.	
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.
May 20	Gluyas Early ...	20	24	20	48	15	52	20	0	19	16
June 18	Nabawa	22	48	24	16	21	52	20	48	22	24
	Yandilla King ...	22	40	23	4	19	20	19	4	21	4
	Gluyas Early ...	22	0	22	0	23	20	20	8	21	52
	Florence	16	40	15	52	14	32	15	36	15	44
May 20	Gluyas Early ...	24	24	19	44	22	40	21	12	22	0

The yields of the same varieties when planted in May (the same time as the controls), may be obtained from the Variety Trial results. For purposes of comparison the percentage yields of all plantings are as hereunder:—

CHAPMAN EXPERIMENT FARM.
SEASONABLE PLANTING EXPERIMENTS.
PERCENTAGE RESULTS.

—	Hay Yields. April.	May.	June.	Grain Yields. April.	May.	June.
Yandilla King	60	56	54	55	87	103
Nabawa	103	60	49	100	108	114
Gluyas Early	99	100	60	87	100	104
Florence	91	89	43	72	77	73

The better results obtained with the later varieties, when planted in June, are surprising, as it is usually believed that the very early varieties (like "Florence") are most suited for late planting. The season was, however, abnormal, with very good and unusual late rains, which fell after the middle of October. By this time the very early variety was advanced too far to benefit, whereas apparently the other varieties had not.

Whilst the results of the one year's trial are interesting, the period of the trial is too short for them to be regarded as conclusive, especially as the season was not a normal one.

WHEAT EXPERIMENTS AT THE MERREDIN EXPERIMENT FARM.

J. H. LANGFIELD, Manager.

WHEAT VARIETY TRIAL.

In continuation of the experiment carried out last year sixteen varieties with Gluyas Early as a control were tried this season and were planted in each section in the same order as shown in the tables of results herewith. Each section was repeated eight times. Three of the sections were harvested for hay, and five for grain. The total number of plots in the experiment was 168, covering an area of 21 acres.

The land was ploughed in June, and was cultivated with the "Springtyne" in September, 1923, with the Disc implement in March, 1924, and harrowed early in April after good rains. This was to encourage the weeds to germinate and also to conserve moisture. Later it was again cultivated twice, just before seeding, and harrowed after the drilling. The seed of the different varieties was planted at the rate of 45 lbs. per acre during the third week in May, and superphosphate applied at the rate of 84 lbs. per acre.

The germination was good, and all plots showed splendid growth throughout. Owing to the dry period experienced in September blighted ears were plentiful in places, sections 3 and 4 being affected the most.

The results obtained are given in tables I. and II. herewith, and these also include the percentage yield of those varieties tried last year.

TABLE I.

WHEAT VARIETY TRIALS—MERREDIN EXPERIMENT FARM—1924.

Planted, May 24. Seed, 45lbs. Superphosphate, 84lbs.

HAY YIELDS.

Variety.	Computed Yield per Acre.									Average. 1924.			Percentage. 1924.	Percentage. 1923.
	Section 1.			Section 2.			Section 3.							
	cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.		
Gluyas Early ...	52	0	16	46	1	4	42	3	20	47	0	16	100	100
Yandilla King ...	50	3	12	45	1	20	36	2	0	44	1	4	94	...
Gluyas Late ...	50	0	16	44	2	0	43	2	24	46	0	16	98	97
Wannon	47	2	24	41	1	20	38	1	12	42	2	0	90	...
Federation	51	2	24	43	1	4	42	2	16	45	3	12	97	89
Gluyas Early ...	51	1	4	42	1	20	48	3	12	47	2	0	100	100
Hard Federation ...	49	2	0	42	1	20	42	0	0	44	2	16	94	91
Gallipoli 58/1 ...	44	0	8	36	2	24	34	3	4	38	2	0	81	...
Nabawa	44	3	4	39	1	12	37	0	8	40	1	20	85	84
Gresley	52	0	0	43	0	16	38	3	4	44	2	16	94	103
Gluyas Early ...	54	0	0	46	0	8	41	2	0	47	0	24	100	100
Nungarin	48	1	12	42	1	12	35	2	8	42	0	8	90	87
Nizam	39	2	8	37	1	4	30	3	4	35	3	12	77	...
Nangeenan	43	2	8	41	0	8	36	0	8	40	0	24	86	89
Belka	48	3	4	42	2	8	33	1	12	41	2	8	90	92
Gluyas Early ...	52	3	4	46	0	24	39	0	24	46	0	8	100	100
Carrabin	45	2	24	39	2	24	31	0	16	38	3	12	85	94
Canberra	54	1	4	46	1	20	39	0	8	46	2	8	102	106
Merredin	43	2	8	43	0	8	36	3	4	41	0	16	90	90
Florence	44	0	16	41	0	16	35	0	8	40	0	16	88	96
Gluyas Early ...	50	3	4	44	1	20	41	0	8	45	1	20	100	100

TABLE II.

WHEAT VARIETY TRIALS—MERREDIN EXPERIMENT FARM—SEASON 1924.

Planted, May 24. Seed 45lbs. Superphosphate 84lbs.

GRAIN YIELDS.

Variety.	Computed Yield per Acre.										Average. 1924.		Percentage. 1924.	Percentage. 1923.
	Sect. 1.		Sect. 2.		Sect. 3.		Sect. 4.		Sect. 5.					
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		
Gluyas Early ...	32	8	34	40	31	44	23	44	27	20	29	55	100	100
Yandilla King ...	36	8	37	12	31	20	22	8	24	32	30	16	103	...
Gluyas Late ...	29	4	29	20	26	40	23	4	23	52	26	24	92	104
Wannon	28	16	29	44	24	32	15	28	18	32	23	20	83	...
Federation ...	32	40	35	12	29	28	22	16	25	12	28	56	105	95
Gluyas Early ...	28	0	27	44	26	24	22	56	28	48	26	46	100	100
Hard Federation ...	28	56	27	44	24	32	13	36	25	4	24	0	92	86
Gallipoli 58/1 ...	30	16	31	12	27	12	15	4	26	16	26	0	102	...
Nabawa	30	40	29	36	24	0	17	44	27	28	25	52	104	106
Gresley	27	52	26	56	21	12	15	44	27	12	23	44	98	90
Gluyas Early ...	21	52	25	44	21	52	20	16	27	44	23	30	100	100
Nungarin	29	36	31	12	23	52	19	36	29	28	26	48	112	82
Nizam	26	48	15	44	20	56	15	12	26	56	21	4	86	...
Nangeenan ...	27	12	28	0	17	52	15	44	27	28	23	12	93	88
Belka	24	0	24	16	14	40	14	0	25	44	20	32	81	82
Gluyas Early ...	29	12	27	4	21	20	24	48	27	20	25	57	100	100
Carrabin	29	36	29	36	20	24	22	8	26	48	25	44	97	91
Canberra	32	32	30	40	23	20	25	36	32	40	28	56	108	103
Merredin	33	4	27	44	20	16	19	4	28	32	25	44	95	103
Florence	26	56	22	32	15	36	14	40	23	44	20	40	75	73
Gluyas Early ...	33	28	29	12	22	56	24	48	29	12	27	36	100	...

From the tables herewith a comparison can be made of the relative productive merits of the different varieties for hay and grain during the two seasons 1923 and 1924. It must be remembered that the season just ended was an abnormal one, with good rains after the middle of October, thus tending to suit the late maturing varieties. The previous season was one of plentiful rainfall which was light during the ripening period.

From an examination of the yields obtained it will be apparent that sections 3 and 4 are consistently lower in yield than those of the remaining sections, this lowering of the yield being due to a difference in soil type, which, on the affected section, was of a light fluffy character. It is of interest to note that the variety affected least by these conditions was Gluyas Early, and it would thus appear to be a useful variety on soils of this nature.

EARLY *V.* LATE PLOUGHING FOR FALLOWING.

During the past season an experiment was commenced to determine the effect of early and late fallow ploughing upon the yield. Two half-acre plots contiguous to each other were ploughed 4 inches deep with the Disc plough; the first on May 28th, and the other on August 26th, 1924.

On the first plot the land was in good condition for ploughing and was easily brought to a good tilth. The soil on the plot ploughed later was then rather hard and was difficult to plough to an even depth, and broke into fairly large lumps. After ploughing, both plots received the same cultivation, viz., were cultivated with "Springtyne," etc.

At the time of planting the first plot was in good order, but the second was cloddy. The variety of wheat used was "Nabawa," which was planted on the 16th May, with seed at the rate of 45 lbs. and superphosphate (22 per cent.) 84 lbs. per acre.

The yields obtained are as hereunder:—

MERREDIN EXPERIMENT FARM.

EARLY AND LATE PLOUGHING EXPERIMENT—1924.

Variety "Nabawa." Planted 16-4-24. Seed 45lbs. Superphosphate 84lbs.

Plot.	Date of Ploughing.	Grain.			Hay.			
		Computed Yield per acre.		Percentage.	Computed Yield per acre.			Percentage.
		bus.	lbs.		cwt.	qrs.	lbs.	
1	28th May, 1923 ...	30	48	100	45	1	12	100
2	26th Aug., 1923 ...	27	52	89	40	3	12	90

The results of both hay and grain are decidedly in favour of early ploughing, but apart from the increased yield obtained because of it, it becomes imperative to plough as early as possible, for the land often becomes so hard during August and September that ploughing cannot be done thoroughly.

Late Fallow. Ploughed August 26, 1924.

DEPTH OF PLOUGHING EXPERIMENT.

As in previous years, three plots were used for this experiment, being ploughed 4in., 6in., and 8in. deep respectively. They were ploughed in June, and cultivated in September. No further attention was given them until March; they were then worked with a Disc implement, harrowed after early April rains, and cultivated with the "Springtyne" twice before seeding.

The variety used was "Nabawa" and was sown on at the rate of 45 lbs. per acre, and at the same time superphosphate (22 per cent.) at the rate of 84 lbs. per acre was applied.

Early Fallow. Ploughed May 28, 1924.

This experiment has been conducted continuously since 1915. The results for this year and for the duration of the experiment are as hereunder:—

MERREDIN EXPERIMENT FARM.

DEPTH OF PLOUGHING EXPERIMENT—1924.

Variety "Nabawa." Planted 16-4-24. Seed 45lbs. Superphosphate (22%), 84lbs.

HAY YIELDS.

No. of Plot.	Depth of Ploughing.	Computed Yield per Acre.						Percentage. 1924.	Average Percentage, 1915-1924.
		1924.			Average, 1915-24				
		cwt.	qrs.	lbs.	cwt.	qrs.	lbs.		
1	4 inches ...	49	2	8	50	0	16	93	104
2	6 inches ...	53	2	0	48	0	8	100	100
3	8 inches ...	49	2	8	49	3	4	93	104

GRAIN YIELDS.

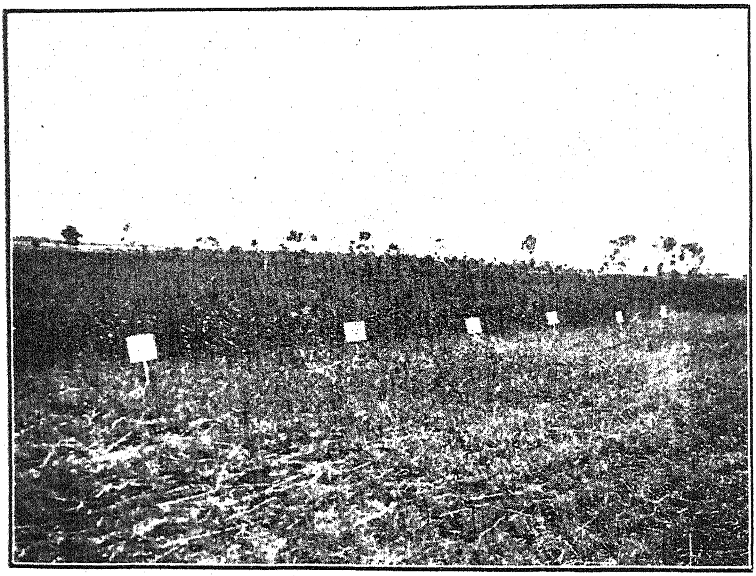
No. of Plot.	Depth of Ploughing.	Computed Yield per Acre.				Percentage. 1924.	Average Percentage, 1915-1924.
		1924.		Average, 1915-24			
		bush.	lbs.	bush.	lbs.		
1	4 inches ...	32	29	24	26	101	102
2	6 inches ...	32	13	23	52	100	100
3	8 inches ...	30	13	23	10	94	97

SEASONABLE PLANTING EXPERIMENT.

For a number of years this experiment has been conducted in the test rows, but owing to the fact that the same conditions under which it was grown did not obtain under crop conditions, it was decided to carry out this trial as a field experiment.

Five varieties were used, viz., "Yandilla King," a recognised late variety; "Nabawa," a midseason; "Gluyas Early" and "Merredin," early; and "Florence," very early variety. These varieties were planted adjacent to each other in sections with "Gluyas Early" as a control, beginning and ending the section. Each section was repeated three times.

Three plantings were made, the first on the 8th April, the second the middle of May, and the last on the 16th June. "Yandilla King" was not included with the others in the April planting, as at that time the seed, which was being obtained from the Chapman Farm, had not come to hand. Control plots of "Gluyas Early" planted on May 23rd were used throughout the three plantings.



A Section of the Seasonable Planting Experiment. Merredin, 1924.

In all cases the rate of seed was 45 lbs. per acre, and that of superphosphate (22 per cent.) 84 lbs. per acre.

When the early planting was made the land was in fair condition, but there was not sufficient moisture to germinate all the seed; about half of it came up directly after planting, but the balance did not germinate until the 20th May. The April planting was thus very largely in effect equivalent to May planting. That which germinated first came into ear very early, especially the "Florence," some ears of this variety being clear of the sheath on

the 4th July, whilst ears of the "Gluyas Early" and "Merredin" were clear on the 20th August. The earliest three varieties suffered from blighted ears, "Florence" being much the worst.

The results obtained from the April and June plantings are shown in the table hereunder:—

MERREDIN EXPERIMENT FARM.

SEASONABLE PLANTING EXPERIMENT.

Date of Planting.	Variety.	Computed Yield per Acre.						Average Yield.		Percentage. Yield.
		Section 1.		Section 2.		Section 3.				
		bush.	lbs.	bush.	lbs.	bush.	lbs.	bush.	lbs.	
May 23rd ...	Gluyas Early ...	30	24	27	52	30	32	29	36	100
April 8th	Nabawa	33	52	31	12	32	48	32	40	109
	Gluyas Early ...	24	32	25	20	24	40	24	48	82
	Merredin	23	12	27	52	25	4	25	20	83
	Florence	19	28	21	36	15	4	18	40	60
May 23rd ...	Gluyas Early ...	32	32	29	44	31	52	31	20	100
May 23rd ...	Gluyas Early ...	20	0	20	32	23	20	21	20	100
June 16th	Yandilla King ...	20	48	20	48	22	24	21	20	101
	Nabawa	21	52	21	44	24	24	22	40	107
	Gluyas Early ...	21	44	19	52	22	40	21	28	102
	Merredin	19	28	17	12	20	8	18	56	90
	Florence	12	40	9	44	11	12	11	12	54
May 23rd ...	Gluyas Early ...	19	36	19	36	23	12	20	48	100

The yields obtained from the varieties planted in May may be had from the results of the main Variety trial.

For comparative purposes the percentage yields abstracted from the tables of these results, together with the percentage results from the April and June plantings, are shown below:—

MERREDIN EXPERIMENT FARM.

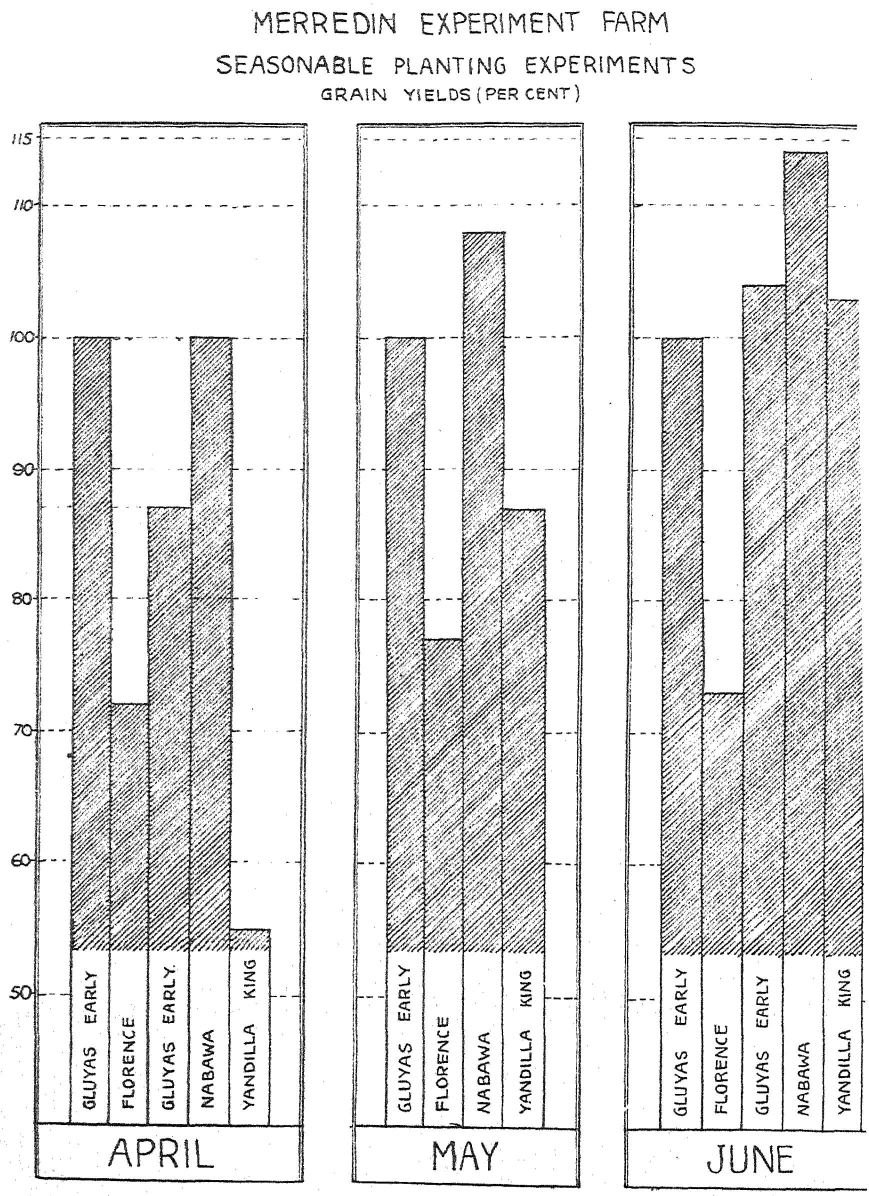
SEASONABLE PLANTING EXPERIMENT.

Percentage Results.

GRAIN YIELDS.

	April	May.	June.
Yandilla King	...	103	101
Nabawa	109	104	107
Gluyas Early	82	100	102
Merredin	83	95	90
Florence	60	75	54

It will be noted that the very early variety, "Florence," planted in June, has not yielded nearly as well as the later maturing varieties. This is contrary to expectations and may be due to the peculiarity of the season, as unusually good late rains were experienced during the third week in October, by which time "Florence" was practically matured, whilst the other varieties were in a condition to respond to the rain. This point will be watched with interest as the experiment proceeds.


MERREDIN EXPERIMENT FARM
SEASONABLE PLANTING EXPERIMENTS
GRAIN YIELDS (PER CENT)
115
110
100
90
80
70
60
50
GLUYAS EARLY
FLORENCE
GLUYAS EARLY
NABAWA
YANDILLA KING
APRIL
GLUYAS EARLY
FLORENCE
NABAWA
YANDILLA KING
MAY
GLUYAS EARLY
FLORENCE
GLUYAS EARLY
NABAWA
YANDILLA KING
JUNE

METEOROLOGICAL INFORMATION.

1925.

MARCH, 1925.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					points.	points.
Chapman Experiment Farm	88·0	100·6	64·6	55·9	102	46
Geraldton	84·1	98·3	67·6	57·4	101	39
Walebing	85·4	99·5	58·4	43·0	89	71
Perth	80·1	94·1	62·4	55·3	119	76
Kalamunda	79·0	91·0	62·7	53·7	64	80
Bunbury	78·9	90·8	...	...	...	101
Bridgetown	78·3	95·0	52·3	37·2	98	101
Albany	72·2	85·0	58·9	50·0	140	151
Merredin Experiment Farm	82·1	97·0	61·3	48·6	43	86
Northam	82·5	97·5	60·4	52·5	288	62
York	82·1	97·0	59·3	49·0	121	56
Narrogin School of Agriculture	77·9	92·5	55·9	42·3	73	64
Katanning	75·7	89·2	55·7	42·8	218	91
Cape Leeuwin ...	72·3	89·8	62·1	57·2	77	123

APRIL, 1925.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					points.	points.
Chapman Experiment Farm	82·4	96·8	56·0	45·2	2	40
Geraldton	78·3	87·5	59·5	47·8	*nil.*	84
Walebing	78·9	98·0	53·8	42·5	9	78
Perth	75·2	87·9	56·6	44·0	49	159
Kalamunda	74·2	88·5	54·8	43·9	20	159
Bunbury	75·4	86·8	53·0	42·2	83	167
Bridgetown	73·7	88·0	45·1	30·0	52	161
Albany	67·8	77·0	55·9	50·0	384	266
Merredin Experiment Farm	77·2	94·9	51·7	37·8	27	85
Northam	78·4	97·9	48·6	40·0	22	80
York	78·1	96·1	51·0	39·2	10	84
Narrogin School of Agriculture	73·2	92·0	50·0	36·8	39	116
Katanning	71·6	90·0	49·4	37·4	94	115
Cape Leeuwin ...	68·5	78·8	59·3	52·0	369	197

MAY, 1925.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					points.	points.
Chapman Experiment Farm	72·2	86·5	51·5	42·2	250	224
Geraldton	73·1	81·2	57·0	43·1	205	282
Walebing	...	...	...	...	...	249
Perth	69·0	81·2	53·2	42·9	497	495
Kalamunda	...	...	52·6	40·4	671	591
Bunbury	67·7	77·4	50·8	39·8	332	534
Bridgetown	65·0	77·2	43·6	34·0	442	458
Albany	65·0	73·0	52·0	47·0	604	508
Merredin Experiment Farm	66·6	79·1	47·7	35·0	104	135
Northam	70·0	83·5	46·9	35·5	171	223
York	69·6	83·0	47·1	34·0	175	235
Narrogin School of Agriculture	64·9	73·7	46·9	35·3	203	286
Katanning	...	...	...	...	...	235
Cape Leeuwin ...	...	...	...	...	...	568

MARKET REPORT.

Chaff.—The following particulars of the approximate quantities of both wheaten and oaten chaff available for auction at the Metropolitan Chaff and Grain Auction Sales, held in Perth during the months of March, April, and May; also the minimum and maximum prices ruling for f.a.q. to prime quality wheaten chaff during those months have been kindly supplied by Messrs. H. J. Wigmore & Co., Perth:—

March.—Quantity, 2,750 tons.
Minimum price for f.a.q. to prime—£6 15s. per ton.
Maximum price for f.a.q. to prime—£7 per ton.

April.—Quantity—2,700 tons.
Minimum price for f.a.q. to prime—£6 12s. 6d. per ton.
Maximum price for f.a.q. to prime—£7 per ton.

May.—Quantity—3,100 tons.
Minimum price for f.a.q. to prime—£6 5s. per ton.
Maximum price for f.a.q. to prime—£7 per ton.

Wheaten Chaff.—If our last report in this *Journal* is referred to it will be seen that supplies have been heavier during the last three months than the three months preceding; in December 2,450 tons reaching the market, January 1,900 tons, and February 2,400 tons, and this can be accounted for by the truck difficulty being overcome. It will be noticed that in March and April the market fluctuations were small, and right up to the middle of May f.a.q. to prime was selling at up to £6 17s. 6d. per ton. However, immediately rain fell the market weakened, and receded day by day until at the end of May the top price obtainable was £6 5s. per ton. At time of going to press (3rd June) the market is rather weak at £6 5s., but, of course, should we experience a dry spell a firmer tone will be noticeable. From information gathered from the various hay districts there does not appear to be a superabundance of hay, and from a seller's standpoint the position cannot be called an unsatisfactory one.

Oaten Chaff.—In March and April heavy supplies were arriving, and with a poor demand the market was exceedingly dull, f.a.q. selling at around £5 per ton, good mediums £4 15s., and mediums £4 7s. 6d. to £4 10s. However, no doubt owing to farmers being too busy seeding to load chaff, supplies dwindled, and at time of writing there is an excellent demand for f.a.q. at around £5 10s., good mediums at £5 5s., and mediums suitable for cow feed at £4 15s. to £5 per ton.

Oats.—We believe that holdings in the country are fairly heavy, and now that good rains have fallen adequate supplies will no doubt be continually arriving. The demand is not large, and the market is rather dull at around 2s. 8d. per bushel for good heavy feeds, and from present indications there appears to be little likelihood of any improvement for some time.

Wheat.—During the last day or two the market has firmed, and f.a.q. is selling under the hammer at from 6s. 2d. to 6s. 4d. per bushel.

LIVE STOCK AND MEAT.

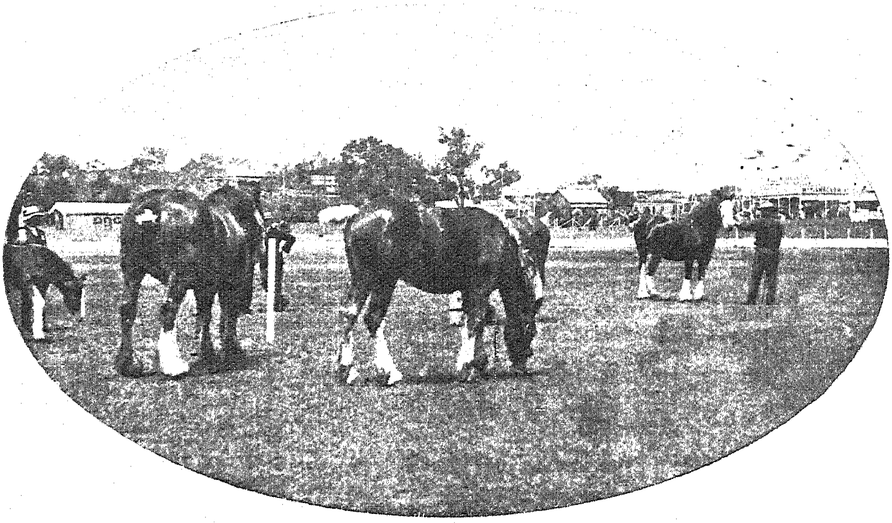
For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF MARCH, APRIL, AND MAY, 1925.

—	March.				April.					May.			
	4.	11.	18.	25.	1.	8.	15.	22.	29.	6.	13.	20.	27.
Sheep and Lambs	7,090	9,596	7,092	6,287	6,923	8,394	6,698	6,090	6,010	6,956	4,738	6,344	5,426
Cattle ...	544	658	145	345	504	175	680	28	610	706	556	734	560
Pigs ...	855	978	809	445	958	944	659	819	530	698	786	407	693

COMPARATIVE VALUES OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF MARCH, APRIL, AND MAY, 1925.

—	March.				April.					May.			
	4.	11.	18.	25.	1.	8.	15.	22.	29.	6.	13.	20.	27.
Mutton	11	11	11¼	11¼	11¼	11¼	11	11½	11½	11¼	11¼	10¾	11¼
Beef ...	8	8	8¼	9½	9½	9½	7¾	7¼	7½	7½	8	8	8
Pork ...	11¾	11½	11¼	12	12	12	11½	11	11¼	11¼	11¼	12	12
Bacon ...	10	10	10	10	10	10	10	10	10	10	10½	9¾	9¼



WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

No. 20.—*The Pruning of Fruit Trees.* By J. F. Moody. Price 2s. 6d.
No. 46—*Fruit Packing and Marketing and Exporting of Fruit.* By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—*The Poultry Keeper's Manual.* By G. Allman. Price 1s.
No. 83.—*Horticulture and Viticulture.* By A. Despeissis. Price 2s.
No. 5.—*Fruit Drying.* By J. F. Moody. Free.
No. 15.—*Root Rot.* By A. J. Despeissis. Free.
No. 24.—*Hints to Stock Breeders* (revised). By R. E. Weir. Free.
No. 41.—*Irrigation and Drainage.* By A. H. Scott. Free.
No. 49.—*The Feeding of Horses.* By Professor Paterson and G. L. Sutton. Free.
No. 57.—*Vermin Destruction.* By A. Crawford. Free.
No. 60.—*The Farmer's Clip.* By J. J. Mahood. Free.
No. 68.—*Flaying and Treatment of Hides.* By R. E. Weir. Free.
No. 72.—*The Potatoe: Its Cultivation, Pests and Diseases.* By G. N. Lowe, L. J. Newman, D. A. Herbert. Free.
No. 74.—*Tobacco Growing: Notes for Intending Planters.* By G. W. Wickens. Free.
No. 79.—*Sheep on the Wheat Farm and their Management in W.A.* By H. McCallum. Free.
No. 81.—*The Improvement of Pastures.* By E. A. Mann and D. A. Herbert. Free.
No. 87.—*Sheep Feeding Experiments: State Farm, Chapman,* 1920. By G. L. Sutton and F. Vanzetti. Free.
No. 88.—*Light Land: Conference.* By G. L. Sutton. Free.
No. 90.—*Stock Waters: Standard for Composition of.* By E. A. Mann. Free.
No. 93.—*The Home Tanning of Sheep and other Skins.* By H. Salt. Free.
No. 94.—*The Dingo.* By B. W. Leake. Free.
No. 95.—*The Stickfast Flea.* By L. J. Newman and Geo. Allman. Free.
No. 96.—*Poison Plants of W.A.* By D. A. Herbert. Free.
No. 99.—*Australian White.* By G. L. Sutton. Free.
No. 101.—*Cotton Cultivation.* By G. L. Sutton. Free.
No. 103.—*Kerosene Method for Eradicating Zamia Palm.* By G. K. Baron-Hay. Free.
No. 104.—*Stickfast Flea.* By J. G. C. Campbell. Free.
No. 105.—*Pedigree Selection of Seed.* By G. L Sutton. Free.
No. 106.—*The Red Legged Velvet Earth Mite.* By L. J. Newman. Free.
No. 107.—*Sudan Grass.* By G. L. Sutton. Free.
No. 108.—*Lucerne.* By G. L. Sutton. Free.
No. 109.—*Rape.* By G. L. Sutton. Free.
No. 110.—*Subterranean Clover.* By G. K. Baron-Hay. Free.
No. 111.—*Standard Wheat Varieties.* By. G L. Sutton and F. Vanzetti. Free.
No. 112.—*Automatic Device for Eradication of Stickfast Flea.* By G. Allman. Free.
No. 113.—*Picked Pieces (Classification of Clip).* Free.
No. 114.—*Blue Mould on Citrus Fruits.* By W. M. Carne. Free.
No. 115.—*The Value of Windmills for pumping Water in W.A.* A. H. Scott.
No. 116.—*Spotted Wilt of Tomatoes.* W. M. Carne.
No. 117.—*Cream.* P. G. Hampshire.
No. 118.—*Pigs and Pig Raising.* P. G. Hampshire.
No. 119.—*Take-all of Wheat and Similar Diseases of Cereals.* By W. M. Carne and J. G. C. Campbell.
No. 120.—*Pastures in the South-West.* A. B. Adams. (Reprint from "Journal.")
No. 121.—*Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals.* W. M. Carne and J. G. C. Campbell.
No. 122.—*Fruit Fly. Description and Control.* L. J. Newman.
No. 123.—*The Development of a Dairy Herd.* P. G. Hampshire. (Reprint from "Journal.")
No. 124.—*Government Inspection of Wheat.* G. K. Baron-Hay. (Reprint from "Journal.")
No. 125.—*Buy Good Seed.* (Advice to Farmers.) W. M. Carne. (Reprint from "Journal.")
No. 126.—*The Rust of Cereals.* W. M. Carne and J. G. C. Campbell.
No. 127.—*Wheat Yields—Competitions.*
No. 128.—*Woolly Aphis Parasite (Aphelinus mali).* (Hald.) L. J. Newman. (Reprint from "Journal.")
No. 129.—*The Farm Horse: Hints on Feeding.* A. McK. Clark. (Reprint from "Journal.")
No. 130.—*Minerals and the Health of Cattle.* A. B. Adams. (Reprint from "Journal.")
No. 131.—*The Strength of Wheat and Flour.* R. G. Lapsley. (Reprint from "Journal.")
No. 132.—*Development of a Dairy Herd—No. 2.* P. G. Hampshire. (Reprint from "Journal.")
No. 133.—*Kikuyu Grass for Poultry.* G. L. Sutton. (Reprint from "Journal.")

No. 134.—*Flag Smut of Wheat.* W. M. Carne. (Reprint from "Journal.")
No. 135.—*The Objects of Farmers' Trials.* G. L. Sutton. (Reprint from "Journal.")
No. 136.—*The Use of the Scythe.* H. Campbell. (Reprint from "Journal.")
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No. 143.—*Zamia Palm and "Rickets" in Cattle—Method of Eradication.* A. B. Adams and G. K. Baron-Hay.

The following publications may be obtained from the Department of Agriculture, Perth, on application, or will be sent post free to any address in this State on receipt of a remittance for the amounts stated:—

The Handbook of Horticulture and Viticulture of Western Australia, by A. Despeissis, M.R.A.C.: This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible it has been reduced to 2s.

The Pruning of Fruit Trees, by J. F. Moody, Fruit Industries Commissioner: This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price, 2s. 6d.

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Agricultural Bank.

ADVANCES TO FARMERS.

The Agricultural Bank, which is a State institution and is worked under a Special Act was founded with the object of making advances to settlers for the purpose of assisting and encouraging them during the early years of the development of their farm.

The Agricultural Bank makes advances on approved securities to approved persons engaged in the business of farming or grazing, or in horticultural pursuits, to an amount not exceeding £2,000.

Every application must be made on the prescribed form, and must contain full particulars of the purposes for which the advance is required.

Where an advance is approved for effecting improvements on the borrower's land, such advance is made by progress payments as the work progresses.

Developmental advances are usually made for clearing, fencing, ringbarking, and water supply, and are made to the full value of the work done after it has been inspected and certified to by a responsible officer. After a reasonable stage of development has been reached, and providing the general progress of the settler is considered satisfactory, limited assistance is granted towards building (maximum £250), and money is provided to assist in the purchase of stock and machinery, the maximum amount for this purpose, except in special cases, being £150.

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The security required by the Bank is a first mortgage over the lands on which the advance is to be expended, and such lands may consist of:—

(a) Holdings in fee simple; or
(b) Holdings under Special Occupation Lease or Conditional Purchase from the Crown; or
(c) Homestead Farms; or
(d) Such other real or leasehold property as the Trustees may think fit.

Mortgages are prepared free of charge; but borrowers are required to pay the statutory costs of registration.

Interest only on the advances made is charged during the first 10 years, and repayment of the capital does not commence until the eleventh year.

Application may be for sums of £25, or any multiple thereof, not exceeding £2,000. Each application must be accompanied by a valuation fee of one per cent of the amount applied for. No refund of fee is allowed after an inspection of the security has been made.

The leases, or Occupation Certificate, as the case may be, together with the fees, must be in the possession of the Bank before a mortgage can be prepared.

REGISTRATION FEES.

	s.	d.
For each Conditional Purchase, Homestead Farm, or Grazing Lease under the Land Act	5	0
For each Freehold Lot or Crown Lease	10	0
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STAMP DUTY

	s.	d.		s.	d.
Up to £50	1	3	From £301 to £400	10	0
From £51 to £100	2	6	„ £400 „ £500	12	6
„ £101 „ £150	3	9	Stock Bill of Sale, up to £50	5	0
„ £151 „ £200	5	0	„ „ over £50	10	0
„ £201 „ £250	6	3	Machinery Bill of Sale, up to £50	5	0
„ £251 „ £300	7	6	„ „ „ over £50	10	0

Intending borrowers are requested to note that no advances are made against improvements effected prior to date of application. Applications should, in every instance, be lodged prior to commencement of work, and moneys are then paid over in progress payments as the work proceeds.

IMPROVED FARMS.

The Trustees of the Agricultural Bank have, from time to time, improved farms on their hands which have been abandoned for various causes, or have been taken over as security for loans. These farms are available for purchase, and extended terms are given for payment of the amount. They often offer to intending settlers an opportunity of obtaining an improved holding, ready for occupation, at a cheap rate, without having to undertake the preliminary work of clearing and fencing. The properties, when obtainable, are advertised in the "Government Gazette"; but anyone wishing for particulars of such farms as may be available should make application to the Managing Trustee of the Agricultural Bank. Particulars will then be sent, and an inspection can be made by the intending settler to ascertain whether the same is suitable for his requirements.

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THE RABBIT INVASION.

For many years past the authorities controlling the agricultural industry of this State have been ceaselessly impressing upon farmers and others the importance of using their best endeavours to bring about the extermination of the rabbit pest. Huge sums of money have been expended by Governments past and present in the construction and maintenance of substantial fences, covering hundreds of miles of country, designed to hold back the invasion that threatened the agricultural and pastoral development of the State. Sheaves of literature have been freely distributed, and expert advice from those who have studied the problem in all its aspects and familiarised themselves with the habits and haunts of the rodent has been broadcasted throughout Western Australia *per viam* the press and Departmental Bulletin. Unfortunately it would be vain to say the results achieved have realised anticipation, and there is evidence that in some cases failure to appreciate the immensity of the danger led to slackness and lack of co-operation. Vermin Boards have been appointed with power to enforce the work of destruction, and inspectors and boundary riders have been urgent in their efforts to ensure as far as possible immunity from the trespassers, but the conclusion is forced that some sinister influence interfered to defeat the objective. Five years ago, although rabbits were not numerous in any particular district, it was known that they were to be found all over the area west of the No. 2 fence, and whilst many there were who earnestly strove to rid their properties of the pest, some treated their warning notices with any airy insouciance fatal to any organised attempt at complete destruction. How far these nuclei are responsible for the present day position can only be conjectured, but certain it is the rabbit has increased enormously, and is here, not in negligible numbers that can afford to be treated unconcernedly, but in a horde that demands vigorous and determined assailment if the farmers are in future to reap the benefit of their toil and industry.

In the last annual report of the Chief Inspector, Mr. Craig, it is gratifying to observe that the menace is more seriously recognised by agriculturists. "Rabbits are still making headway," he writes, "and the outstanding feature has not been the damage they have done in any one locality, but the manner in which they have spread throughout the State. . . . In all the farming districts the Vermin Boards have done greatly improved work, and in the worst infested areas are taking a real and just view and are forcing delinquent settlers to poison during the summer months and give greater attention to fumigation during the winter. In the past 12 months 180 tons of phosphorous poison were distributed."

Just how much loss can be accomplished by rabbits is not always fully recognised, and there are those who believe they represent the foundation of an industry that could be developed into tangible advantages. Reflection, however, will bring the conclusion that this could only be brought about by the sacrifice of far greater industrial enterprises It is estimated that eight rabbits consume the sustenance of one sheep. Does the value of eight rabbits represent anything like that of one sheep? But it is not only the consumption of natural fodder that makes the pest so objectionable, for apart from his depredations on the growing crops, wherever the rabbit thrives he leaves a pasture nauseating to the farm stock. Horses and sheep are particularly sensitive in this respect, and greatly handicapped when pastured in the vicinity of rabbit warrens.

From an industrial point of view bunny is scarcely worth more than momentary consideration. During the five years covering 1919 to 1923 the export from the Commonwealth of frozen rabbits and hares amounted to 27,801,595 pairs, valued at £2,233,118, whilst skins to the extent of 491,429 cwt. of £8,700,252 value were sent away. Over the same period 132,979 sheep and 1,152,813,843 lbs. of frozen mutton and lamb, having a value of £15,132,271; sheepskins worth £10,012,963, and wool which realised £232,132,931, were supplied by Australia to the overseas markets. It is readily seen, therefore, that over this quinquennium the value of the two industries is hardly worthy of comparison. Where one has yielded ten millions the other has yielded hundreds of millions. Moreover, whilst wool, the most valuable of the products, is a recurring source of profit, bunny has his hide and carcase to offer for but once its value. But this is to take only the value of our wool industry as against a possible industry in frozen rabbits and skins that might be built up at the expense of inestimable damage to growing crops and despoilment of valuable pastures. There can be raised no logical and valid reason for sparing the scourge. It simply must be exterminated if this is possible of achievement.

In this regard it should be noted that the process of trapping has nothing to recommend it except the few pounds it may bring to the farmer or professional trapper. It has been proved that as a deterrent this method is little less than useless. Quite recently the rural interests columns of

the "West Australian" while reporting the season's prospects drew attention to the fact that at Tammin rabbits were doing a lot of damage to the crops despite the fact that between 30 and 40 trappers were operating there and over 200 dozen rabbits sent away weekly. In the Eastern States, Vermin Departments, Royal Commissions, and Select Committees have found common agreement, after years of experience, that trapping is not only ineffective but is actually harmful, and tends to increase rather than diminish the numbers. The most effective methods yet discovered are poisoning and fumigation, and, as has been stressed in official Bulletins, one month's fumigation will destroy more rabbits than six months of trapping.

Of the many evils against which the farmer has to contend there is none more serious than the depredations of this vermin, and too great attention cannot be given to its elimination. There have of late been appeals for greater co-operation between Vermin Boards and an extended scope for their authority and action. There is certainly no greater need than concerted action on the part of these bodies, and it is for the individual farmer to augument their efforts by resolutely bending to the task of combating the rabbit invasion.

"THE JOURNAL OF AGRICULTURE"

will be supplied free *on application* to any person in the State who is following Agricultural, Horticultural, or Viticultural pursuits, to Agricultural Societies or Associations, and to any person otherwise interested in Agriculture.

A charge of Threepence per copy will be made for the *Journal* to persons other than the foregoing, or who do not reside in the State. These applications, accompanied by the requisite amount, must be forwarded to the Director of Agriculture, Department of Agriculture, who will also receive all correspondence dealing with the conduct of the *Journal.*

Editors of agricultural and country papers are invited to reproduce any of the articles contained in this *Journal,* providing the usual acknowledgment is made.

If you are not receiving the *Journal,* which is issued quarterly, and wish to do so, please forward your name and postal address to the Director of Agriculture, Perth.

THE MAKING OF GRASS HAY.

A. B. ADAMS, Dipl.Agric.
Agricultural Adviser, Dairy Branch.

During the 1924 season probably more grass hay was made in the South-West than during any previous year. In some cases, the quality was unfortunately not as good as it might have been, had the growers been fully conversant with all the factors necessary for success. There have been generally only two faults which have caused this lack of quality in the hay, viz.:—

1. *The grass was cut too late.*—It is established knowledge that leaf is more nutritious than stem, and that as a grass plant approaches ripeness the digestibility and productive value of its dry matter diminish; hay made from ripe grass that has lost leaf and seed is merely straw. Early mowing involves some loss of weight and a greater loss of bulk, but the additional weight and bulk obtained by later cutting represent matter of little nutritive value. From English figures (and probably local figures, if available, would give comparatively similar results), hay is not usually as nutritious as pasture grass without water.

100lbs. of the dry matter of pasture grass grown on good soil yields 56lbs. of productive nutriment (starch equivalent), whereas 100lbs. of the dry matter of good hay yields 36lbs. and poor hay 20lbs. of productive nutriment.

A milch cow can extract all the nutriment she requires in a day by consuming about 27lbs. of pasture dry matter.

To obtain the same quantity of nutriment from the good hay above she would require to consume 42lbs., an amount which is beyond her digestive capacity. Very good hay tends to approach in character the dry matter of pasture grass, while poor hay resembles straw.

It has been proved, by feeding trials with dairy cows, that hay made by carefully drying short leafy grass has the same nutritive value as fresh grass.

Cattle-feeders know that a feeding pasture fattens best when the grass is kept reasonably short; if allowed to run up and become stalky, such good results are not obtained. These two facts emphasise the importance of early mowing and suggest the desirability of experimental work, to ascertain whether the increased nutritive value of hay made from two or more cuts of shorter herbage could be secured at an economical cost.

One settler during last season reported that he had cut a portion of his Subterranean clover paddock for green feed in October, obtaining a large amount of feed. On cutting the whole paddock in November, the portion cut in October had caught up to the rest of the paddock. The writer examined the plot and found that there was quite enough seed on the ground to give a good stand the next season.

Although an isolated instance does not prove that the same result will be obtained on all soils, and on the same soil a different result might follow in a different season, nevertheless it certainly suggests the advisability of each farmer cutting a small portion of his clover as soon as it has made sufficient growth. He will thus gain knowledge of value to himself, and if the results are published, of value to his district and the State as a whole.

2. *The crop after cutting was left too long exposed to sun and weather.*—The usual causes of loss in hay-making may be placed under four heads:—

(a) Respiration: The grass does not die immediately after cutting, but continues to respire and consume its cell contents. The loss from this cause in a moist climate has been known to amount to over 10 per cent. of the dry matter of the crop.

The farmer in this State is unlikely to experience sufficiently prolonged moist weather to cause heavy losses from respiration.

(b) Shedding: As a rule there should be no broken leaves to shed. The loss of leaf and other fine portions of the fodder is due to over drying and to rough treatment of the crop.

(c) Leaching: Untimely rain, falling on half-dried grass spread over a large surface, may remove a large proportion of the sugar and the soluble ash constituents of the fodder. Windrows and especially well-made cocks are capable of resisting, to some extent, the action of rain.

(d) Overheating in the stack: Mow-burnt hay contains little digestible carbo-hydrate and the digestibility of its protein is very low. Losses up to 30 per cent. of the nutritive value of the hay have been recorded as due to over-heating in the stack.

From the foregoing it will be realised that to obtain hay of the highest possible feeding value, certain principles must be remembered. In the first place the crop must be cut on the early side; this is especially true if there is any large area to be cut, as if that first cut is approaching maturity the last cut will be over ripe.

If there is a large proportion of Silver and Spear grasses in the herbage early cutting is especially to be recommended, as though they have a fair feeding value when green they are of little value when ripe, and they ripen very rapidly with the onset of warm weather.

Hot dry weather is of advantage, as it kills the grass rapidly and prevents losses from respiration. Once the bulk of the grass is killed, the sooner the crop is run up into windrows and cocks the better, provided that it is not handled when the leaves are brittle. If tender during the heat of the day it can generally be handled safely in the cool of the evening, or first thing in the morning.

In this State we are unlikely to get sufficient rain to cause leaching; loss is far more likely to be caused by overlong exposure to a hot sun and dry winds.

Loss from both these causes may be prevented by running up into cocks as early as possible.

Over-heating in the stack is most unlikely to happen if the hay is allowed to lie in the cock a few days before being carried.

For the conduct of farm operations in general and for hay harvesting in particular recipes can be of only very limited service, applicable only under certain conditions. It is otherwise with principles, an understanding of which enables the farmer to adapt his methods to his varying circumstances and requirements, and to draw more valuable lessons from each season's experience.

Many farmers had difficulty last season in cutting the grass crop with the mowing machines in their possession, grass and clover being far more difficult to cut than a cereal crop.

The following remarks on some of the common difficulties of mowing machines are from the "Journal of the British Ministry of Agriculture," April, 1923:—

"Heavy draught is caused by—

"(1) Poor lubrication.

"(2) A dull set of knives.

"(3) Non-alignment of the cutter bar.

"The remedies for (1) and (2) are obvious, but the importance of (3) is frequently not appreciated. The cutter bar should work at right angles to the machine when actually cutting; the resistance of the grass frequently causes the bar to drop back a little, and some manufacturers recommend setting the end of the cutter bar forward a distance of about 1½ inches. With the cutter bar working at right angles, the knife, connecting rod, and pitman wheel are in approximately a straight line.

"If the bar drops back and alters the alignment it causes increased friction on the inside shoe parts, and this friction causes increased draught but does not cause side draught, as is often supposed. Non-alignment seldom occurs in machines with under three or four years' service; the majority of modern mowers are provided with methods for adjusting the alignment of the cutter bar. When making the adjustment great care must be taken that the adjustment does not prevent the knife sections registering with the fingers.

"*Uneven cutting and side draught.*—These troubles are due principally to a poorly adjusted cutter bar. It must be appreciated that the principle on which a mowing machine cuts is the same as that of a pair of shears; if the blades are held closely together a clean cut results, but if the blades are held loosely the material wedges and will be pulled and not cut. If at the end or beginning of a thrust by the connecting rod the knife sections do not centre, only a portion of the grass wedged between the fingers will be cut. The remaining grass, which is not cut, but pulled, offers resistance, and is consequently the cause of side draught.

"It will be seen therefore that the causes of above are:—

"(1) The knife sections not being firmly pressed against the ledger plates; and

"(2) The knife sections not centreing with the fingers.

"To correct (1) the attention must be given to the guards, clips, and knife sections. If the guards are out of alignment, the bent ones must be straightened or replaced. Should the clips not be pressed firmly against the back of the knife, the clips should be tapped down gently with a hammer, or replaced. Where both old and new blades are used the clips should be adjusted for the new blades.

"As to (2), one of the main reasons why on some machines accurate centreing does not take place is that the drag-bar is sometimes altered to bring the cutter-bar more forward. This alters the position of the whole cutter-bar in relation to the knife. The remedy is to adjust the drag-bar. A second reason for non-registering lies in the use of a pitman connecting-rod, which is either too long or too short. This latter trouble is not likely to arise in machines with iron connecting-rods.

"Side draught is not so much a matter of width of cut as of properly adjusted parts."

CALCULATING THE WEIGHT OF HAY STACKS AND THE CAPACITY OF TANKS AND DAMS.

GEO. L. SUTTON,
Director of Agriculture.

In order to calculate the weight of hay in a stack it is necessary to determine its volume or cubic contents, and also to know the space occupied by a given weight of hay, say a ton, or to have some data from which this latter information can be calculated.

With regard to this latter requirement it should be noted that the weight of hay occupying any given space is not constant, but depends upon a number of different factors, the principal of which are:—

(1) The character and condition of the hay.
(2) The size of the stack.
(3) The age of the stack.

The weight of a cubic foot of hay in different stacks will probably vary, but experience will supply the information required in connection with a particular kind of hay and type of stack, and in this connection, as the result of experience, the schedule hereunder showing the number of cubic feet required to weigh one ton of hay has been adopted for insurance purposes, and is considered to be satisfactory for average Western Australian conditions:—

Number of cubic feet per ton of Hay.

	Oaten Hay.		Wheaten Hay.	
	Sheaf.	Loose.	Sheaf.	Loose.
Immediately on completion of stack ..	350	400	400	500
One week after completion	325	375	375	450
One month after completion	300	350	350	400
Twelve months after completion ..	300	325	350	400

In the event of the data in the schedule being considered unsatisfactory, in some particular case, and in the absence of experience, very definite and accurate information in connection with any stack can be obtained by cutting out a rectangular truss of hay from about midway between the eaves and the ground. By carefully measuring and weighing the truss, the weight per cubic foot can be ascertained.

For calculating the volume of a hay stack a short method quite commonly adopted, and which may be called the "average" method, is to multiply the average length by the average width, and the result by the average height.

The average length and width is ascertained by measuring the length and width of the stack midway between the ground and the eaves, and the average height by finding the height from the ground to the eaves, and then adding to this half the height between the eaves and the ridge.

This method is only accurate when the ends of the stack are vertical, so that the length and width of the stack is the same at the ground level as at the eaves, and when the ends of the roof are not "hipped" or sloping. Such

a stack would be as in Fig. 1, and is the kind usually found in a hay shed, and rarely, if ever, in the field. The length and width of this stack being the same at the ground as at the eaves, the dimensions at these places would also be the average. In this case the average height would be 17 feet, this being found by adding the height from ground to eaves, viz., 12 feet, to half the height of the roof, viz., 10 feet, *i.e.*, 12 feet + $\frac{10}{2}$ = 17 feet.

In accordance with the above rule the volume of such a stack would be, therefore—Length × width × average height = 51 feet × 30 feet × 17 feet = 26,010 cubic feet.

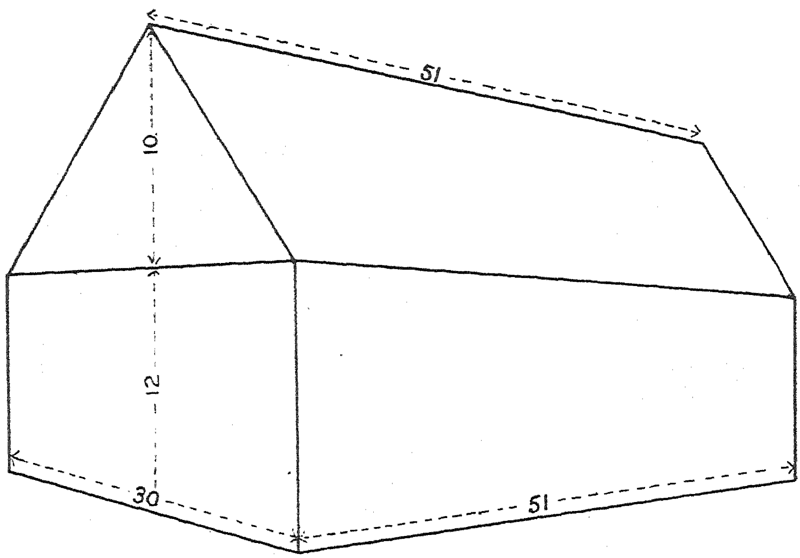


Fig. 1.

Having obtained the volume of the stack, and having decided upon the space which it is considered will be occupied by a given weight of hay, *e.g.*, that 350 cubic feet weigh one ton, its tonnage is determined by dividing the total volume by the number of feet referred to, thus: 26,010 ÷ 350 = 74 tons approximately.

Practically all stacks built in the open are longer and wider at the eaves than at the ground, and many of them have their tops built with sloping ends as in Fig. 2. Though the "average" method already illustrated is a good rough and ready approximation, it has the disadvantage that it is not quite accurate. To secure accuracy it is necessary to use another method which is longer, but not very much more difficult. It requires that the volume above and below the eaves be calculated separately and then added together. The rules for finding the volumes of stacks according to this method are based upon the formula that the volume is equal to the sum of the areas of the top, bottom, and four times the middle area added together, then multiplied by the height, and the product divided by six.

This formula has the advantage that, in addition to being accurate, it can be used for calculating the contents of any figure, providing the top is parallel to the bottom, and that their edges are connected with straight lines. It is, therefore, also useful for calculating the volume of circular stacks, stone-heaps, and embankments, and for determining the capacity of excavated tanks with sloping sides.

The stack illustrated in Fig. 2 being rectangular, the area of the bottom is found by multiplying the length by the width; the area of the top will be found in a similar manner, and four times the middle area will be found by adding the length at the bottom to the length at the top, and multiply-

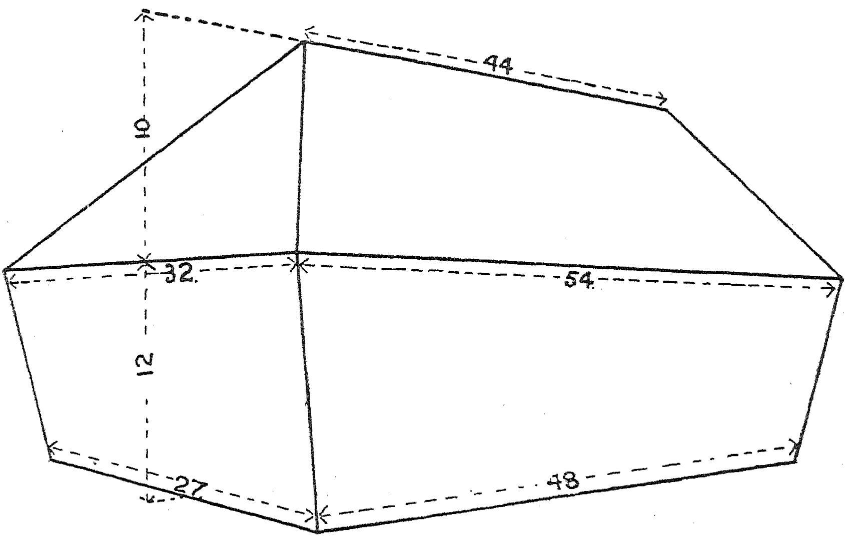


Fig. 2.

ing this by the result of adding the widths at the top and bottom together. In accordance with the above formula the rule for determining the volume below the eaves will be—

(a) Multiply length at ground by width at ground.
(b) Multiply length at eaves by width at eaves.
(c) Add length at ground to length at eaves, and multiply the result by the sum obtained by adding the width at ground to the width at eaves.
(d) Add (a), (b), and (c) together, multiply by the height, and divide by six.

The rule for finding the volume above the eaves, and also adapted from the formula already given, will be—

(a) Multiply the length at the eaves by the width at the eaves.
(b) Add length at eaves to length at ridge, and multiply by width at eaves.

(c) Add (a) and (b) together and multiply by the height, and divide by six.

To find the volume of the stacks similar to those illustrated in Fig. 2, it is necessary, therefore, to have the following dimensions:—

Length and width at the ground.

Length and width at the eaves.

Height from ground to eaves.

Height from eaves to ridge. (The perpendicular, not the slant height, is required.)

Length at ridge.

By applying the rules given, to the dimensions shown in Fig. 2, it will be found that the volume of the stack is—

(1) Volume below the eaves—

a. Length at ground × Width at ground	48 × 27	= 1,296
b. Length at eaves × Width at eaves	54 × 32	= 1,728
c. Sum of lengths × sum of widths	102 × 59	= 6,018
a + b + c		9,042
d. a + b + c × height ÷ 6 =	$\frac{9042 \times 12}{6}$	= 18,084

(2) Volume above the eaves—

a. Length of eaves × width at eaves ...	54 × 32	= 1,728
Length at ridge	44	
b. Sum of lengths × width at eaves ...	98 × 32	= 3,136
a + b		4,864
c. a + b × height ÷ 6 =	$\frac{4864 \times 10}{6}$ ...	... 8,106

(3) Total volume—

(1) Volume below eaves	18,084
(2) Volume above eaves	8,106
Total volume	26,190

As all the dimensions are in feet the volume will be in cubic feet.

Had the volume of this stack been calculated by the "average" method, the result would have been:—51 × 29½ × 17 = 25,576, a difference of 614 cubic feet.

Assuming that the weight of hay in this case has been found to be 6½ lbs. per cubic foot, then the weight of the hay in the stack would be 26,190 × 6½ = 170,235 lbs. = 76 tons.

In calculating the volume of circular stacks it is essential to know that when the circumference of a circle or the distance round it is known, the area of the circle is found by multiplying this distance by itself, and then by seven and dividing by 88.

Because of this, and by the application of the original formula, the rules for calculating the contents of circular stacks, as illustrated in Fig. 3, are—

(a) Multiply the distance round the bottom by itself.
(b) Multiply the distance round the eaves by itself.
(c) Add the two distances together, and multiply the result by itself.
(d) Add (a), (b), and (c) together, and multiply the result by $\frac{7}{88}$, then by the height from the ground to the eaves, and divide by six.

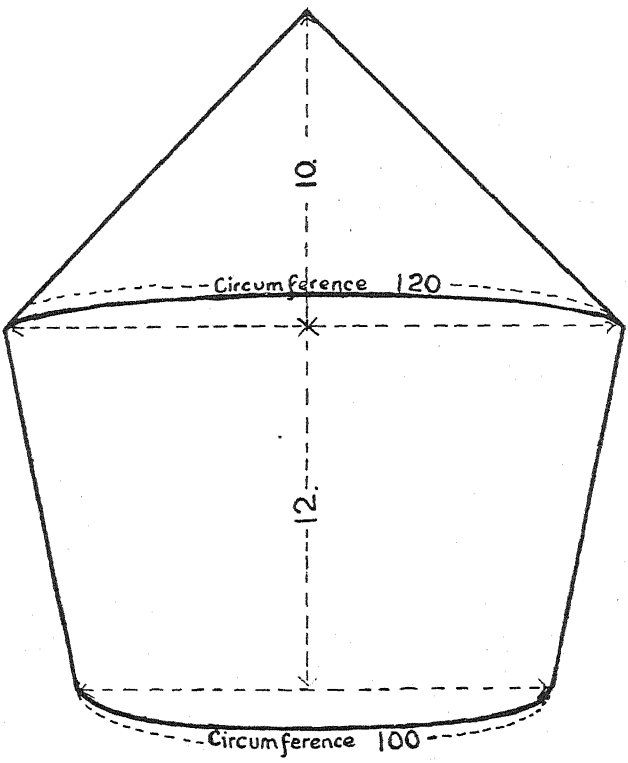


Fig. 3.

Similarly the volume above the eaves is found by multiplying the distance round the eaves by itself, and then by $\frac{7}{88}$, and the result by $\frac{1}{3}$ of the perpendicular (not the slant) height from the eaves to the peak.

The dimensions necessary for calculating the volume of a circular stack are, therefore—

(a) The distance round the stack at the bottom.
(b) The distance round the stack at the eaves.
(c) The perpendicular height from the ground to the eaves; and
(d) The perpendicular height from the eaves to the peak.

Having obtained these dimensions, as shown in Fig. 3, the volume of such a stack will be—

(1) Below the eaves—

a. Distance around bottom × distance round bottom 100 × 100 = 10,000

b. Distance round eaves × distance round eaves ... 120 × 120 = 14,400

c. Sum of distances × Sum of distances ... ... 220 × 220 = 48,400

a + b + c 72,800

d. a + b + c × $\frac{7}{88}$ × height from ground to eaves ÷ 6 =
72800 × $\frac{7}{88}$ × 12 × $\frac{1}{6}$ ... ... = 11,582

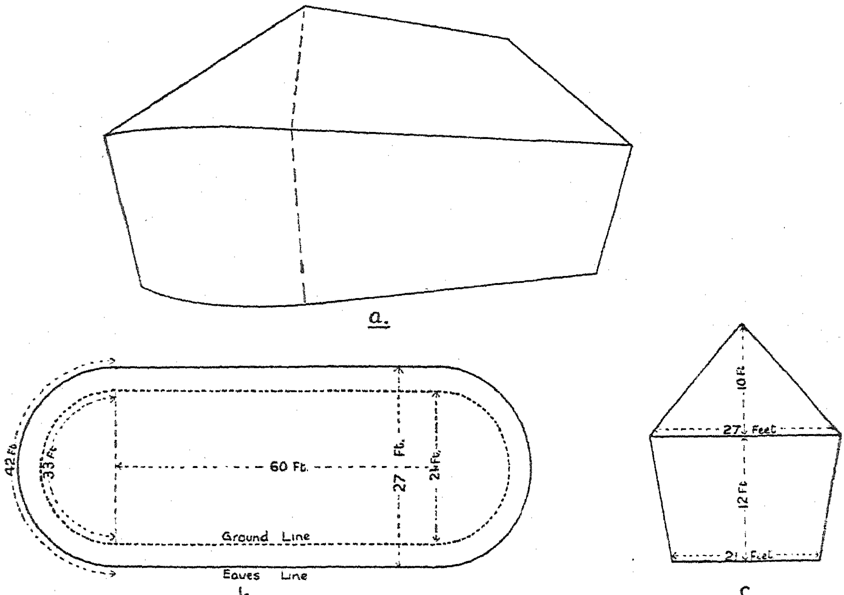


Fig. 4.

(2) Above the eaves—
Distance round eaves × distance round eaves × $\frac{7}{88}$ × height ÷ 3 =
120 × 120 × $\frac{7}{88}$ × $\frac{10}{3}$ ... ... = 3,818

(3) Total volume—

(1) Contents below eaves	11,582
(2) Contents above eaves	3,818
Total contents	15,400

As all the measurements are in feet, the contents are in cubic feet.

Another kind of stack occasionally built is one with semi-circular ends, as illustrated in Fig. 4a, with plan and a vertical end section at the junction of the circular and other portion of the stack, in Figs. 4b and 4c, respectively. From an examination of these illustrations, and by imagining that the stack would be divided vertically by a huge knife so that the circular ends were separated from the central portion, it will be seen that for the purpose of finding its volume, such a stack can be divided below the eaves

into a central rectangular portion with straight ends and sloping sides, and two semi-circular end portions which, if placed together, would form a body similar in shape to that part of a circular stack found below the eaves. Above the eaves it will consist of a central wedge with straight ends, and a cone formed from the two half cones, one at each end.

In accordance with the methods already followed in connection with the calculations of the contents of the rectangular stack, shown in Fig. 2, and the circular stack in Fig. 3, the contents of the circular ended stack, as illustrated in Fig. 4 will be—

Below the eaves—

(1) Central rectangular portion—

a.	Length at ground × width at ground	= 60 × 27 =	1,620
b.	Length at eaves × width at eaves	= 60 × 21 =	1,260
c.	Sum of lengths × sum of widths	= 120 × 48 =	5,760
	a + b + c	=	8,640
d.	a + b + c × height ÷ 6 = $\frac{8640 \times 12}{6}$		17,280

(2) Two semi-circular ends—

a.	Distance round bottom (2 ends) × distance round bottom	= 66 × 66 =	4,356
b.	Distance round eaves (2 ends) × distance round eaves...	= 84 × 84 =	7,056
c.	Sum of distances × sum of distances	= 150 × 150 =	22,500
	a + b + c		33,912
d.	a + b + c × $\frac{7}{88}$ × height to eaves ÷ $\frac{1}{6}$ = 33912 × $\frac{7}{88}$ × 12 × $\frac{1}{6}$		5,395

Above the eaves—

(3) Central wedge-shaped portion—

a.	Length at eaves × width at eaves	= 60 × 27 =	1,620
	Length at ridge	= 60	
b.	Sum of lengths × width at eaves	= 120 × 27 =	3,240
	a + b		4,860
c.	a + b + height ÷ 6 = $\frac{4860 \times 10}{6}$		8,100

(4) Two half-cone sections—

Distance round two sections at eaves × distance round two sections at eaves × $\frac{7}{88}$ × height ÷ 3 = 84 × 84 × $\frac{7}{88}$ × $\frac{10}{3}$ 1,871

Total volume of stack—

(1)	Volume below eaves, Central portion	17,280
(2)	„ „ „ (2) Semi-circular ends	5,395
(3)	„ above eaves Central portion	8,100
(4)	„ „ „ 2 conical ends	1,871
	Total contents	32,646

As all measurements are in feet, the contents are in cubic feet.

Assuming this to be well settled oaten hay in sheaves with one ton occupying 300 cubic feet, its tonnage would be approximately 108 tons.

Dams, Embankments, and Stone-heaps.

The method used to find the volume of the lower part of the rectangular haystack, illustrated in Fig. 2, can be used to ascertain the quantity of earth received when excavating a tank, as in Fig. 5. The same rule can also be used for ascertaining the quantity of material contained in embankments, stone-heaps, etc. The dimensions required for the purpose being the length and width at top and bottom and the vertical height.

In the case of the excavated tank, illustrated in Fig. 5, the volume of earth removed would be—

a.	Length at bottom $\times$ width at bottom	$= 30 \times 9 =$	270
b.	Length at top $\times$ width at top	$= 126 \times 89 =$	11,214
c.	Sum of lengths $\times$ sum of widths	... $156 \times 98 =$	15,288
	$a + b + c$		26,772
d.	$a + b + c \times \text{depth} \div 6 = 26772 \times 16 \times \frac{1}{6}$	$=$	71,392

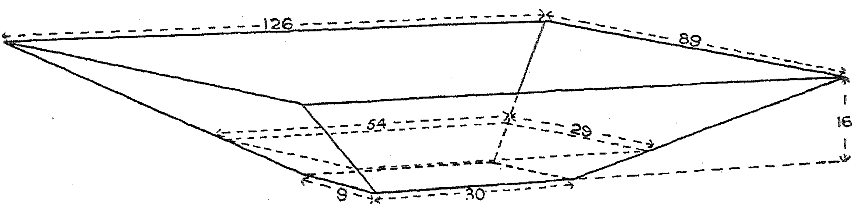


Fig. 5.

As all measurements are in feet, the contents are in cubic feet, and to reduce these to yards it is necessary to divide by 27, thus making the capacity in cubic yards = 2,644.

As a cubic foot will hold $6\frac{1}{4}$ gallons, or a cubic yard $168\frac{3}{4}$ gallons, the capacity of such a tank when full can be determined by multiplying its contents, if in feet by $6\frac{1}{4}$, or if in yards by $168\frac{3}{4}$.

The amount of water in a partially-filled tank can be determined in a similar way after ascertaining the vertical depth of the water and the dimensions of the tank at water level. Thus, in Fig. 5, the water level is indicated by the dotted line, and is assumed to be four feet from the bottom of the tank. The dimensions of the tank at this level are readily found when the batters are known, or are determined from the top and bottom dimensions of the tank. At the water level shown they will be—length 54 feet, width 29 feet, and the capacity of the tank at the water level will, therefore, be—

a.	Length at bottom $\times$ width at bottom	$= 30 \times 9 =$	270
b.	Length at water level $\times$ width at water level	$= 54 \times 29 =$	1,566
c.	Sum of lengths $\times$ sum of widths	$= 84 \times 38 =$	3,192
	$a + b + c$		5,028
d.	$a + b + c \times \text{depth} \div 6 = \frac{5028 \times 4}{6}$	$=$	3,352 cubic feet.

As there are $6\frac{1}{4}$ gallons in a cubic foot, the quantity of water in the tank is, therefore, $3{,}352 \times 6\frac{1}{4} = 20{,}950$ gallons.

THE SCIENCE OF COOKERY.

FOREWORD.

Most farmers' wives are justly proud of their domestic and culinary attainments, yet in these days of progressive land settlement there must be many of the younger order starting a new phase of life unequipped with the qualification and experience necessary to this important branch of their duties. Altogether apart from these, however, at country demonstrations given annually by the Inspectress and Organiser of the Domestic Science Classes it has been made clear that the wisest are those who seek further wisdom, and the experienced housewife has invariably evinced a pleasing and appreciative interest which has been followed by written requests for more information. By arrangement with the Education Department the Journal has secured a series of articles from the pen of Miss M. A. Wylie, the first of which appears in this issue, dealing with the science of cookery, and is submitted with the firm conviction that this new departure will appeal to the lady readers of these pages. It is not intended to confine the scope of these articles to this one subject, and as far as possible household hints and useful knowledge will be disseminated.—ED.

Miss M. A. Wylie,
Inspectress and Organiser of Domestic Science Classes.

Some women are born to be cooks; some achieve the art by long and arduous practice; some never try to cook, and others, when they do attempt it, have but little success. At some time in life, however, almost every woman has cooking to do, or she is called to superintend or pass judgment upon the cooking of others; hence knowledge of the subject is essential to all.

Cooking is a means of bringing about certain chemical changes in foods, rendering them more tender and easier of digestion; it is a means of making foods more palatable, and of producing certain appetising dishes with distinctive flavours; but if there is ignorance of the principles of cookery, the food value is lost and the desired changes do not take place.

The first point to consider is the value of the food substances used. These may be briefly classified according to the particular part they play in the nourishment and maintenance of the body.

Meat contains albumen, which is flesh-forming material.
Fish contains gelatine, which is flesh-forming material.
Eggs contain albumen, which is flesh-forming material.
Milk contains casein, which is flesh-forming material.
Flour contains gluten, which is flesh-forming material.
Peas and beans (pod vegetables) contain legumen, which is flesh-forming material.
Flour contains starch (as well), which is heat and energy producing.
Grains contain starch, which is heat and energy producing.
Meals contain starch, which is heat and energy producing.
Sugar of milk, fruit etc., fats of animals, nuts and butter, are heat givers.

In all fresh foods, especially in milk, fruit and vegetables, the Vitamines known as A, B and C are found. These may be considered as the living elements, the presence of which acts as a preventive to various diseases of the skin and body, and assist in the growth of cell tissue.

The science of cookery not only aims at preserving the value of the food substances tabulated, but at breaking down and softening the fibrous network and walls of the cell that contain them. These objects are achieved by heat, either moist or dry, for heat at various temperatures effects changes in food. Water boils at 212° F., when it bubbles; fat, at 360°-400° F., when a blue fume rises—bubbling fat indicates the presence of water, which should be eliminated; albumen hardens at 212° F., and at that stage is indigestible. Thus, foods containing albumen should never be allowed to reach boiling point either in oven or water. It is a well-known fact that the white of an egg—almost pure albumen—when exposed to long and great heat becomes tough and horny. This is particularly noticeable in the edges of an over-fried egg. It should always be remembered that the shell of an egg only protects the albumen from hardening, through contact with heat, for from 2½ to 3 minutes; after that time the heat penetrates and affects the texture.

The old axiom, "stews boiled are stews spoiled," is a good one, and capable of infinite application.

Custards boiled are custards spoiled,

Soups boiled are soups spoiled.

Meats boiled (after first 10 minutes) are meats spoiled, as these foods are chiefly albuminous and flesh-forming, which are hardened if exposed to 212° F. Proper care in cooking can make meat tender; improper cooking can make meat tough. Again, foods containing starch, such as flour, rice and cornflour, require boiling or steaming to burst their starch cells. This is noticeable in the thickening of a white sauce. It should therefore be noted that—

Boiled puddings should be kept boiling,

Steamed puddings should be kept steaming,

until the starch cells throughout the mixture are cooked and the puddings removed from the moisture. Steam is the gaseous state of boiling water. Vapour is not steam, but moisture rising from water by means of condensation. It takes longer to steam food than to boil it, as in boiling it is in direct contact with the water.

This article will simply introduce a series dealing with the various methods of cookery, and will briefly treat with the cooking of meats.

The Cooking of Meats.

Red and white meats are composed of bundles of fibrous tubes which contain the albumens or food juices. If cut these juices are apparent and begin to ooze out and, coming in contact with the outside air, coagulate on the surface. The principles to be observed in meat cookery are—

First: That cold water opens and softens the fibres of meat and allows the juices to escape. (Experiment.—A glass of cold water containing a bit of raw meat: note the colouring of the water with the red juices.) For

soups and stews, therefore, the liquid in which the meat is to be cooked must be cold to begin with, and the cooking carried on at a moderate temperature.

Second: That if the juices are to be retained, a coating in some way must be provided to protect the surface of the meat and prevent their escape. In roasting, baking and boiling joints, for instance, the meat should be exposed—as the case may be—to a hot fire, a quick oven, or boiling water, for the first ten minutes. After that the cooking should be carried on at a moderate temperature, when there will be gradual softening of the fibres. During the first ten minutes of great heat the surface albumen becomes hardened to about the thickness of a sixpence, thus forming a casing to keep in the juices.

In shallow frying, small pieces of meat should have their surface sealed at once by exposure to boiling fat for a minute on each side and then cooked evenly for 4 or 5 minutes on each side according to the thickness of the piece.

Roasting is really cooking by the direct rays of the fire, as in the olden days, when the joint was hung in front of a fire and allowed to slowly rotate so as to produce even results. Grilling closely resembles this method of cooking, and after exposing the surface of the meat for a minute on each side for the sealing process it should be cooked evenly and turned frequently.

Third: After the weight of a joint has been decided, the time to be allowed for cooking should be considered. For large joints, pork and veal, 20 to 25 minutes to the pound should be allowed, with 20 minutes extra. For a thin piece, poultry and game, 15 minutes to the pound and 15 minutes extra.

With these principles in view the various methods for cooking meats may be easily followed.

To Bake a Joint.

1. Wipe, weigh, and trim the meat.

2. Allow time for cooking.

3. Place on a trivet or meat stand in a baking tin with fat above and below. (If the fat on the meat is plentiful it may not need more.)

4. Place in a hot oven for the first 10 minutes, then either remove to a cooler part of the oven or reduce the temperature.

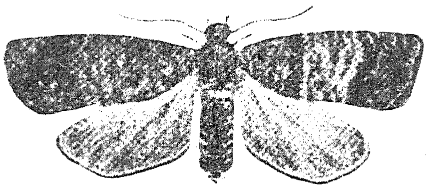
5. Baste about every 20 minutes; that is, lift up with a large spoon some of the hot fat and pour it over the meat. This prevents the meat from drying and assists cooking.

CODLIN MOTH.

(*Carpocapsa pomonella.*)

L. J. NEWMAN, F.E.S.
Entomologist.

The long period of immunity enjoyed by the fruit industry of this State from the Codlin Moth was broken on the 2nd of April, when this much-dreaded pest was discovered to have established itself in a small orchard in the North Dandalup district, some 40 miles south of Perth.



Adult Codlin Moth.

It is some twenty-three years since the first outbreak of Codlin Moth was recorded in Western Australia. Since then there have been fifteen outbreaks, the last being in the year 1918.

Full grown larva or caterpillar.

It has been stated in the Eastern States that these various outbreaks have not been fresh introductions, but are recrudescences of the original and first introduction. This we assert to be quite incorrect, and if any proof is needed, the fact that it is seven years since the last outbreak is a sufficient answer. It would not be possible for the pest to be present in our fruit areas during this period, and not assert itself, and thus be discovered either by the growers or our field officers. All orchards, markets, and fruit exported are subjected to inspection, thus assuring that if present the pest would be discovered. There is no doubt whatever but that it is re-introduced each time per medium of fruits brought into the State from the Eastern States, where the moth is rampant.

In regard to the introduction of pip fruits, it is well that the offending public responsible for the bringing in of the same should understand that under the Plant Diseases Act of 1914 it is enacted that pip fruits are totally prohibited. Clause 6 reads as follows:—"Prohibit the bringing into the State generally from any other State, territory, or country of apples, pears, or quinces."

It is regrettable that this pest has again made its appearance in the State. We appeal to the public to assist the Department in preventing these outbreaks by submitting entirely to the law, and refraining from bringing any pip fruits into the State. The present outbreak has fortunately been discovered in time, and before it has spread beyond the bounds of the small isolated orchard in which it was found.

The Department has every confidence that it will be dealt with as successfully as in the past, and that the State will again be able to claim perfect freedom from Codlin Moth. These past excellent results have not been achieved without severe restrictions on the marketing of the fruit, the enforcement of orchard sanitation, spraying, and bandaging of the trees. There has also been the constant attention and vigilance of the Entomological and Fruit Industries Staffs.

To this departmental supervision must be added a very important factor which has meant much in our successful efforts against this pest, namely, the hearty co-operation of the fruit growers. Fortunately there has always existed this feeling between the growers and the Department.

It has been suggested that some parasite is responsible for the control of the Codlin Moth in Western Australia. So far, in any of the outbreaks, we have failed to discover a predaceous or internal parasite that would control or exterminate it. In fact the moth has proved to be very virile, and if prompt and energetic measures had not been taken in each outbreak, the State to-day would have been permanently infested throughout its apple areas.

In view of the serious position that will occur should the moth break bounds and become thoroughly established, it is earnestly desired that all fruit-growers and others report at once to the Department of Agriculture any insect which they suspect might be some stage of this pest.

It can be emphatically asserted that in other countries many a fruit-grower's prospects have been ruined by its ravages. The American authorities state of the Codlin Moth that it possesses the reputation of causing greater financial loss to the pip fruit industry than the total of other known economic insect pests of these fruits in that country. The absence of this undesirable insect in our pip fruits has been our proud boast, and is of extreme importance to the apple and pear export industry. Freedom of his orchards from Codlin Moth gives the local grower a distinct advantage over his Eastern competitors.

To check the dissemination of this and other insect pests, the first line of action is the application of prompt and correct measures for its isolation and eradication, and to accomplish this desirable end the Department of Agriculture relies on the active co-operation of the grower.

Summarised, the following points will be found useful in the identification of this pest:—

1. Codlin Moth attacks apples, pears, quinces, and all other pip fruits.

2. In very severe outbreaks other fruits are sometimes found to be attacked.

3. Two or more broods of Codlin Moth make their appearance during the year in this State.

4. The first brood of moths appears with the blooming of the trees.

5. The larvae of the first brood moths generally enter the fruit at the calyx or blossom end. Those of the second and succeeding broods at many other points, such as where two or more fruits are clustered, or the eggs may even be laid on the leaves and twigs.

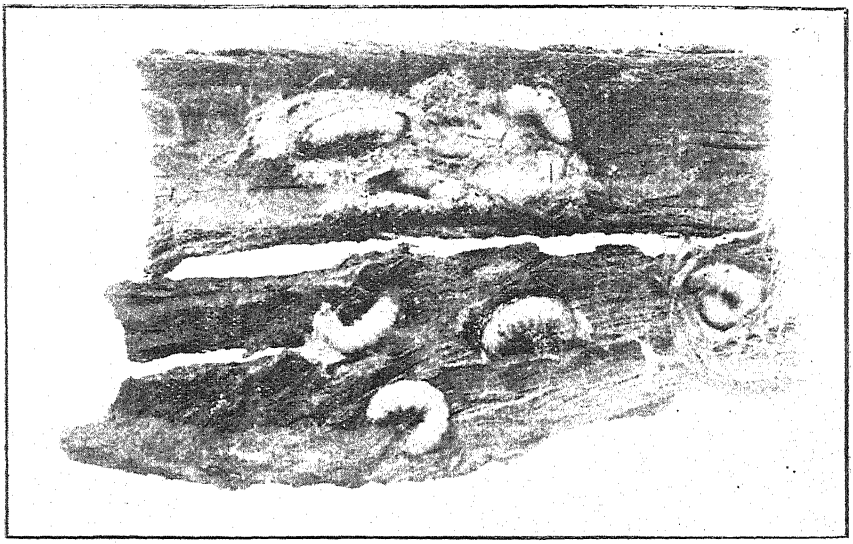
6. Eighty to a hundred eggs are laid.

7. Eggs hatch in 8 to 10 days.

8. Catterpillar stage in fruit 20 to 25 days.

9. Pupal stage (summer) 18 to 20 days.

10. Life of moth, 20 to 25 days.



Hibernating larvae of Codlin Moth taken under bark during month of May.

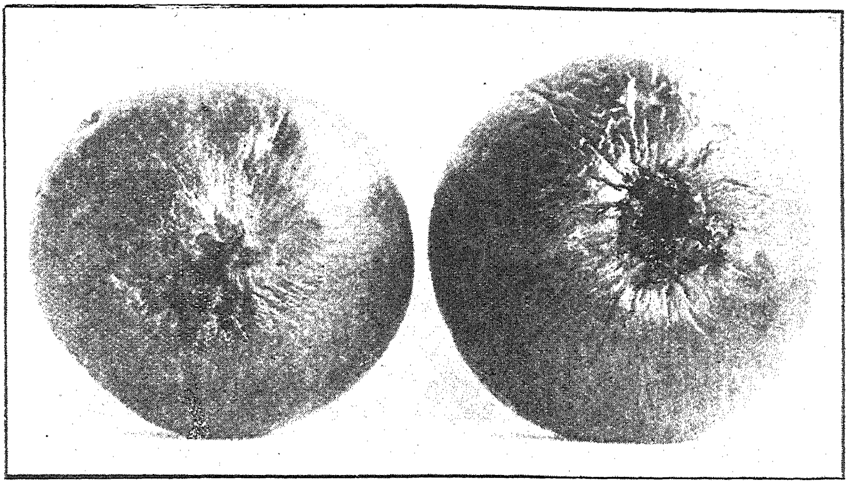
(Original)

11. The last batch of caterpillars in autumn do not at once pupate, but hibernate as larvae within the "cocoon" over winter, transforming into pupae 14 to 16 days before emerging as moths in the spring.

12. Infested fruit can be easily recognised by the brownish moist castings of the caterpillar, generally found in the eye of the fruit, giving it a moist or wet look.

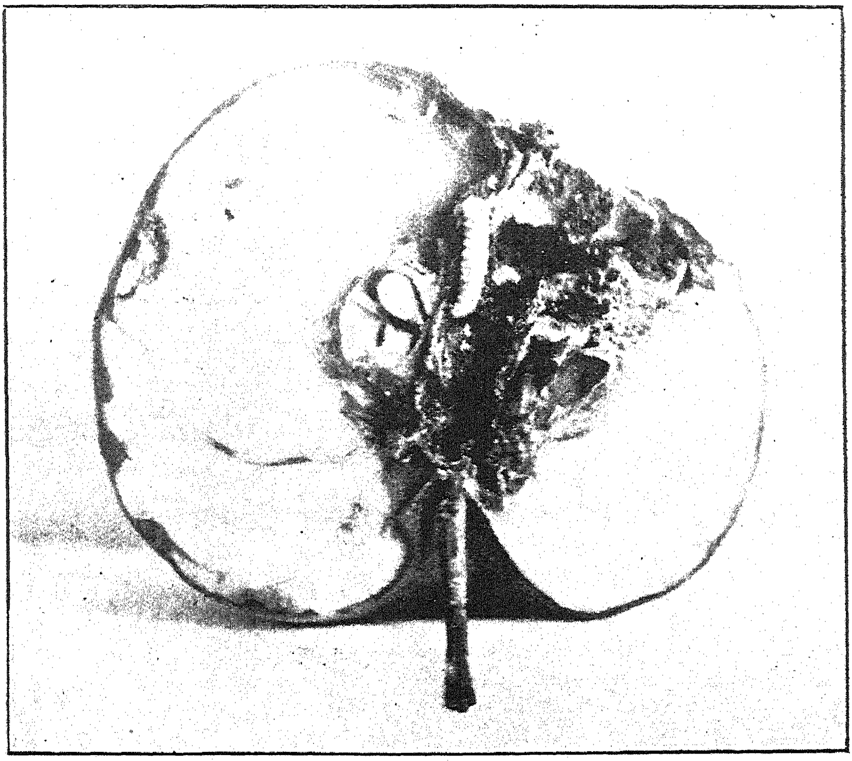
13. The Codlin Moth larva or caterpillar is about half to five-eighths of an inch long, of a fleshy pink colour, and feeds inside the fruit, demolishing the pips.

14. Attacked fruits ripen prematurely and fall.



Apples showing typical castings of Codlin larvae.

(Original)

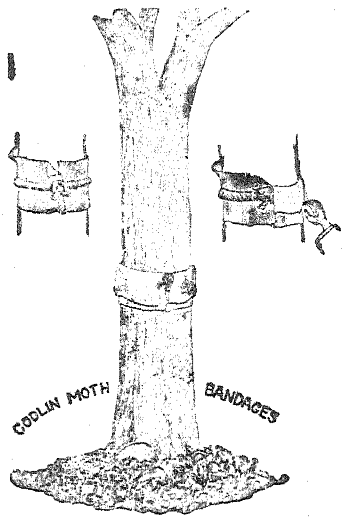


Cut apple showing typical work of caterpillar. Note pips have been consumed.

(Original)

Summary of Prevention.

1. Scrape loose bark from trunk and branches, and clean out all cracks and crevices.
2. Bandage trunks with hessian traps, as shown in illustration, and examine every 10 days.
3. Destroy daily by boiling all infested fruits both on trees and ground.
4. Keep orchard well cultivated and free from rubbish.
5. Keep packing-sheds and store-rooms thoroughly cleaned up and fitted with spring-hinged wire-doors, and windows covered with fly gauze.



Method of tree bandaging for trapping the Codlin caterpillar.

(Original)

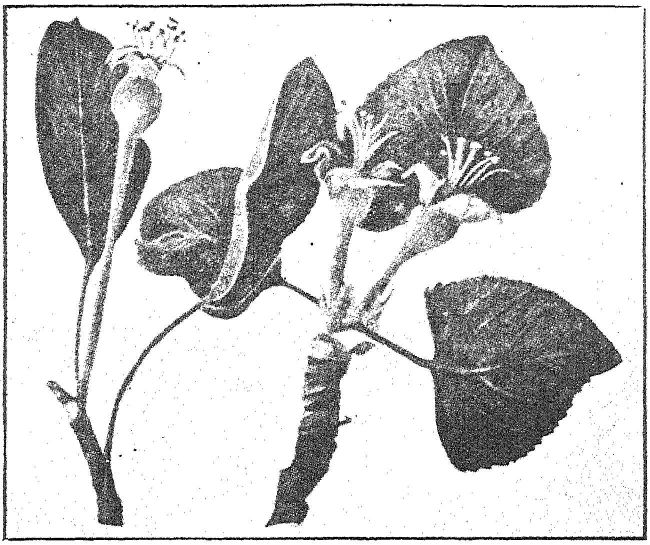
6. Avoid the use of second-hand cases, packages, or bags unless previously immersed in boiling water and soda for at least five minutes.
7. Examine tree trunks for caterpillars or pupae to three inches below the ground level.
8. Thin out fruit to prevent clusters.

Treatment.

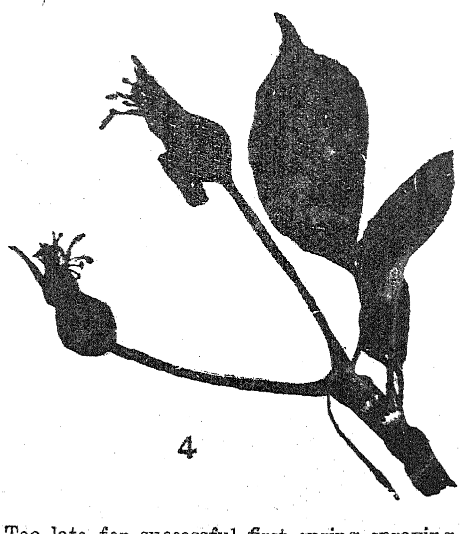
1. Apply first spray just as the petals fall and before the calyx closes, using a coarse nozzle and high pressure.
2. Apply second spray with fine nozzle 10 to 12 days after the first.
3. Third spray follows 14 days later.
4. Fourth spray six weeks after third.
5. Fifth spray 10 to 12 days after fourth.
6. Sixth spray 14 days after the fifth.
7. Should there be a third brood it will be necessary to again spray in March.
8. Arsenate of lead (paste), 2½lbs. or powder form 1½lbs. to 50 gallons of water, is the recommended spray.
9. Use pump with good agitator, maintaining a pressure of at least 90lbs. to the square inch.

10. See that the spray is applied at the right time, and so thoroughly that no blossoms, fruit, or foliage are left uncoated with the poison.

For description of insect and fuller details of prevention and treatment apply to the Department of Agriculture for Bulletin on Codlin Moth.



The above plate was made from a photograph of a flowering specimen of the apple taken immediately after the fall of the petals. The small green lobes which persist after the petals have fallen and are to be seen at the apex of each young fruit, collectively constitute the calyx of the flower. When in this condition the first spray should be applied, as later on the calyx closes over and the young eye of the fruit becomes inaccessible to the spray.



Too late for successful first spring spraying.
Note calyx has closed.

SUDAN GRASS SEED.

W. M. CARNE, F.L.S.,
Economic Botanist and Plant Pathologist.

Examination of samples of Sudan Grass seed obtained from various sources during the past summer showed results as under:—

Average of 17 samples—
- Purity—96 per cent.
- Germination—67 per cent.
- Weeds per lb. of sample—82.

In considering the value of seeds for farm sowing the first point to be taken into consideration is the proportion and character of the weed seeds present. Four samples were found to contain noxious weeds. Of these three were traced to a Perth seedsman, whose remaining stock was immediately condemned. These samples contained Thorn Apple and Bathurst Burr seeds.* The fourth sample, which contained Bathurst Burr, was not traced. It is unfortunate that although growers not infrequently complain about the quality of seed purchased, they usually decline to state from whom the seed was obtained. It is not possible to keep a staff inspecting seeds all over the country, or to undertake more than a limited number of seed tests. Farmers will be watching their own interests if they report cases of the suspected selling of noxious weeds in farm seeds.

The number of weeds per pound of sample in the 17 samples examined varied from *nil* to 390. Outside those already mentioned the weeds were of minor importance, being mainly millets, and other edible plants.

The percentage of sound seed varied from 71 to 99 per cent., and the germination of the sound seed from 38 to 89 per cent.

The best basis for the comparison of samples, after considering the weeds present, is by what is known as the "Real Value," which is obtained by multiplying the Purity and Germination percentages and dividing by 100.

Applying this test to five samples obtained from Perth seedsmen in March of this year we get some interesting results:—

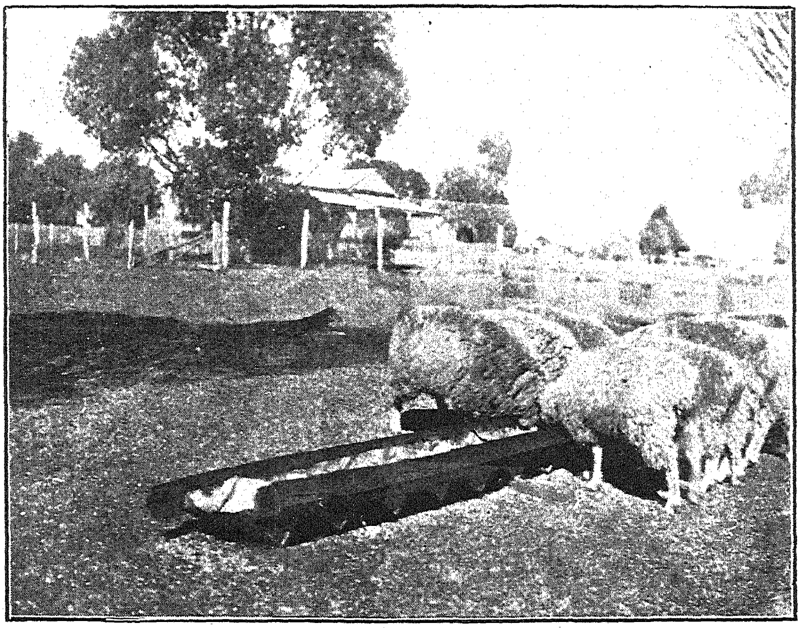
——	Purity.	Germination.	Real Value.	Quoted Price.
				per lb.
Sample A	99·4	81	81	6d.
" B	96·8	38·7	38	6d.
" C	98·8	51	50	6d.
" D	84·8	58·5	50	7d.
" E	71·2	74·0	53	8d.

If sample A was worth 6d. per lb., the values of the others would be B 3d., C and D $3\frac{3}{4}$d., and E 4d. per lb. If sample B was worth 6d. per

* Illustrated in March and June issues of this "Journal."

lb. the values of the others would be A 12½d., C, D, and E 8—8¼d. per lb. It is obvious that a considerable variation in quality occurs, and that a farmer may suffer considerable crop loss by purchasing seed of low quality. The seedsman cannot be relied upon entirely, nor even the prices quoted. It is to be feared that seedsmen's prices are based more upon buying costs and competition with other firms than upon quality. As a matter of fact the best sample came from the same seedsman as the condemned seed containing Thorn Apple and Bathurst Burr. That latter had, if the weeds were ignored, a Real Value of 62 as against 81 for the good seed.

Under the Agricultural Seeds Act farm seeds are required to be sold with a guarantee of germination and purity. The guarantees given by seedsmen at present are for the most part so low as to be worthless. They will naturally continue to give these low guarantees until such time as the farmers demand high quality seed and are prepared to pay for it. So long as farmers remain content to purchase seed which the vendor will only guarantee as poor, no great improvement in the quality of seed sold can be expected.



A useful feeding trough improvised from old petrol tins by Mr. G. C. Spencer, Grass Valley.

HORTICULTURAL NOTES.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

SEASONAL WORK FOR OCTOBER, NOVEMBER, AND DECEMBER.

October.

Every attention must be paid to cultivation during this month. Where the orchardist's work is up to date, plouging and cross-ploughing will have been completed in September, and the cultivator must be continually in operation during October. Should rain fall after the land has been worked down, cultivation should be proceeded with again as soon as it dries out sufficiently to enable the tools to be used without making the soil sticky.

In our fruit-growing districts generally, the winter rainfall has been below the average, but there has been an ample supply for most varieties of fruit if care is taken to conserve the moisture in the soil by thorough cultivation. The pieces of land around the trees which cannot be readily moved with the plough and cultivator should not be left untouched, but should be freed from weeds and loosened with a digging fork or pronged hoe.

In orchards which have been planted out this season special attention must be given to hoeing around the young trees, and this must be carefully done so as not to disturb the roots.

Spraying operations for control of Black Spot of pears (*Ventura pirina*), as set out in the September "Journal," should be carried out this month where necessary.

Powdery Mildew, which has become quite a serious disease on several varieties of apple trees during the last few years, needs attention this month. "Rome Beauty," "Cleopatra," and "Jonathan" are amongst the worst infected, and in orchards where these suffered in the past season they should receive a spraying with atomic sulphur, using 1lb. of atomic sulphur in 10 gallons of water, just after the blossom petals have fallen.

Orange Aphis will be making its presence felt in the citrus groves, and should be sprayed with Black Leaf 40 and soap.

Fruit Fly in the infested districts will be depositing her eggs in the early ripening apricots and peaches before the end of this month, and these, as well as loquats and citrus fruits, require constant attention in baiting and destruction of infested fruits.

White Wax Scale (*Ceroplastes ceriferus*), which has been present in some of the orangeries in the Kalamunda district for some years past was, this year, found by Mr. Read, the Orchard Inspector for that district, to have turned its attention to two native plants—one the Christmas Tree (*Nuytsia floribunda*), which was only slightly infested—the other a shrub (*Sollya fusiformis*), common name "Bluebell," which the scale lives and thrives upon quite as well as on citrus trees. This is the first time that Wax Scale has been reported on native plants in Western Australia, and it behoves all growers whose orange trees are infested to make certain that no

hosts outside the orchard are carrying on the pest. White Wax Scale can be controlled in the citrus groves by spraying with diluted washing soda, but the infested native plants should be grubbed up and burned forthwith.

There is one thing particularly I would like to urge upon all growers, and that is to keep a vigilant watch during the spring and early summer months for signs of Codlin Moth in the apples and pears, and report to this Department at once any indication of the unwelcome stranger. All those who are commercially interested in fruit-growing will have read with interest and some apprehension the reports which were published in the press last summer advising that this most-feared insect pest of the apple-growers has once again found entrance into the State. The last visitation was in 1918 at Caversham, near Perth, and the one before that was in 1914 in Bridgetown. The Bridgetown outbreak possessed the most serious features of any that has occurred concerning the possibility of the moth making a permanent home in the State: for the infested orchard was situated in one of the best apple districts, and within a three-mile radius there were 1,100 acres of apple and pear orchards: but with the whole-hearted co-operation of the growers concerned the infestation was controlled in one year, and the district has been free ever since. The present outbreak is at North Dandalup, and unfortunately was not discovered until a fair proportion of the fruit in the orchard had been marketed, so growers will understand why I am stressing the necessity of vigilantly watching for traces of the pest, and reporting anything suspicious at once.

It is quite possible that some of the apples marketed before the infestation was known may have contained Codlin larvæ, and the moths resulting from these may have found their way into apple orchards in districts far remote from North Dandalup. But what was done at Bridgetown can be done in any other part of the State, provided the pest does not obtain too long a start in the race. In the interests of the apple and pear industry of Western Australia it is essential that every grower should devote time to searching for traces of Codlin, and report at once anything that looks suspicious.

November.

Continue cultivation.

Continue baiting for fruit fly and destruction of infested fruit.

Woolly Aphis will show up in quantities this month unless controlled by parasites or spraying: where parasites are not present spraying must be resorted to, or the pest will destroy the young buds and materially interfere with the crop of fruit to be harvested.

Spray for Pear Slug this month, using 2½lbs. arsenate of lead in 50 gallons of water.

This is the month when thinning of fruit commences, and I think it will perhaps serve a useful purpose to reprint my notes on this operation which were published in the "Journal" of September, 1924:—

The first of the new season's stone fruits will ripen this month in the warmer districts: "Edward VII.," "Bell's November," and similar varieties of peaches being fit for gathering before the 30th. These varieties, if not well grown, are very poor in quality and appearance, and winter pruning

should have been done with the idea of restricting the trees' production by the removal of a large proportion of the fruiting wood: but no matter how carefully and well winter pruning is carried out, it will be found in a normal season that thinning the young fruits is essential if size and quality are to be obtained. This refers not only to the fruits above mentioned but to the major portion of the kinds of fruit now being grown, and I know of no single operation in the work on the orchard that is so generally neglected as thinning out young fruits, nor one that pays better when it is efficiently done. Fruit is sold by the pound or case in Western Australia, and just as many pounds or cases will be gathered from a tree that has been judiciously thinned as from one that has been allowed to overcrop: one fruit on the thinned tree equalling in size and weight two, and sometimes even three, on the tree that has over-cropped. But quite apart from the fact that the quantity harvested is nearly the same, the large-sized, good quality fruit will always find a market and command a price where the small, hard fruit lacking in juice and appearance is difficult to dispose of at any price.

In thinning stone fruits—peaches, apricots, and plums—the operation should be delayed until the natural shedding has taken place. If it is done before, many fruits will be removed by hand that would have fallen naturally. The shedding mentioned will be finished with nearly all varieties early this month. No hard and fast rule can be laid down as to the number to take off: the usual advice with peaches and apricots is to space the fruits to about four inches between them, but the trees rarely fruit evenly enough to allow of this being made an absolute rule. However, they should be thinned so that room is allowed each fruit to develop to the full size for the variety without touching its neighbour, and when the fruit is borne on lateral, willowy growths as distinct from short stiff shoots, care must be taken not to allow more weight of fruit at the ends than the wood can carry.

Apples and pears grow in clusters, at times as many as five together, and according to variety these should be thinned to one or two in each cluster. In dealing with small varieties of apples, such as "Yates," especially where fruiting spurs have been developed right throughout the tree, one apple in each cluster is enough to leave: with "Dunn's" this would result in the fruit being too large, and two in each cluster may be left, provided, of course, the clusters are not too close together. Judgment must be exercised in thinning "Cleo.'s" sufficient always being left on the trees to prevent the fruit becoming over-sized, for where this happens Bitter Pit is sure to follow. "Jonathan's" must not be thinned too heavily, or the fruit will grow large and sappy, and its keeping qualities be spoiled.

For the grower who is a novice at thinning and fears, when he looks at the ground after he has been at work on a tree for some time, that he has sacrificed too much of the crop, the best plan by far is to count the fruits he has left on one of the main limbs, and gauging the strength of the limb and vigour of the tree he will know by the number of fruits whether he has taken too many or too few, calculating what number of the variety in question is required to fill a case when they reach maturity. I may say here that the beginner nearly always errs on the side of leaving too many on the tree.

In thinning apples and pears which, as stated above, grow in clusters, care must be taken to remove the fruits and leave the stems attached to the

spurs. If the stems are taken off with the fruits, the whole cluster is weakened, and the remaining fruits are liable to fall at a later date. With practice it is comparatively easy to take hold of an apple and bend it upwards in such a way that the stem parts readily from the fruit, but this can be done only if thinning is being carried out when the fruits are still quite small, or are naturally long-stemmed varieties. If they are short-stemmed like, for instance, "Jonathan's" and the apples in the cluster are touching each other, it is nearly impossible to remove one with the fingers without endangering the safety of those left behind. A small pair of scissors with blunt points makes a useful tool: a lemon clips can also be used, or a sharp budding knife in skilful hands performs the work rapidly and well.

December.

Continue cultivation.

Complete the work of thinning out apples and pears.

Carry on the war against fruit fly.

Take special notice of, and report at once, anything that resembles Codlin Moth or its larvæ.

Spray for Orange Aphis where necessary. The heat of summer will, no doubt, have a checking influence on the pest this month, and spraying may not be necessary, but where needed it is false economy not to apply it.

In the stone fruit districts marketing will occupy a large amount of growers' time this month. Grade to size and quality. Never mix large and small fruits, nor good and inferior fruits in the same case.

FARMERS.

A caustic critic thus defines the farmers whom he has met: "There are three kinds of farmers. The first is the fellow who says, 'I have no use for books or papers; my father farmed well, and my grandfather before him, and I guess I will be able to do so too.' The second is the fellow who before he can sow his oats in the springtime has to go in and consult some of his books or some of the notes he took while at college, and the same thing if he wishes to know if his hay is ready to cut, and all the other farm operations likewise. This is what you call the book farmer. Then the third is the fellow who has the thorough practical training from the ploughing of the land through all the different stages to the selling of his products in the open market, and has been assisted with a course at some good agricultural college. Thus practice and theory banded together give the proper sort of harvest, and in most cases the right sort of a man to manage any farm or garden."

TABLE POULTRY AND METHOD OF FATTENING.

W. T. RICHARDSON,
Poultry Adviser.

It is surprising to see in our markets the number of birds offered for sale that are not anywhere near marketable condition. Particularly does this refer to cockerels. Good-framed birds are plentiful enough, and that is all that can be said in their favour.

Buyers, while appreciating a good frame, look for more than that. It must be well covered with tender meat, rapidly grown. Size is not everything. Plumpness is the determining factor to good prices.

There is a ready market, in fact a constant demand, all the year round for prime table poultry, at prices that will return a good margin of profit to the grower. This demand should easily be satisfied because the birds are there, yet how many of them are sold profitably: very few indeed, for the very reason that the condition is not on them to justify the label "Prime Poultry."

The complaint is often heard that it does not pay to send birds to auction for table purposes. I heard that statement repeatedly during a recent visit to some of the wheat-growing districts, and while there is a large element of truth in it, when applied to the average run of birds submitted for sale, yet if those same birds had been suitably fed for a short period they would have turned that loss into a profit. Size being a secondary consideration, tenderness and condition must be aimed at.

The most suitable age to market cockerels is when they are about five months old, after which they develop sinew and become tougher as they advance in age.

Select a number of birds to be fattened and dust thoroughly the feathers under their wings and round the region of the vent with sulphur, tobacco-dust, or wood ashes. It stands to reason that birds infested with lice or mites do not show that contentment which is necessary if they are to put on weight rapidly.

Once they are freed from parasites place them in coops, to carry from two to six birds according to size, in a quiet spot where they will not be subject to constant visits and annoyance from other fowls. These coops need not be elaborate affairs, as long as they are high enough to allow their inmates to stand full height comfortably, large enough to enable the birds to move with ease without inducing exercise, and light in weight so that they may be shifted to clean ground as often as is necessary. Light timber or saplings can be used in their construction, covered over with netting and darkened with bags; the darker the better. The front must be slatted, that is to say, made of saplings or narrow strips of board nailed vertically with a clearance of two inches between each to allow the birds to feed through. Or, if you knock the side out of a box and nail a few vertical strips of wood in place of the side, and place under the box as many cockerels as it will hold comfortably, you have a suitable coop for fattening purposes.

Any old box or timber used should be thoroughly disinfected, so as to destroy any red mite that might be present.

A feed tin (waste sheet iron with sides and ends bent upwards), the length of which will be governed by the holding capacity of the coop, should be placed outside and against the slats, allowing sufficient space for the water vessel.

No bottom is required to the coop when same is on dry ground or under shelter. If out in the open a loose sheet of iron placed over it will afford shelter from the rain and sun.

Method of Feeding.—Only finely ground meals should be used, such as pollard, bran, maize meal, etc., mixed with water or skimmed or separated milk, by preference, to the consistency of porridge, and fed three times a day, as much as they will eat in fifteen minutes. Any that is left over should be removed and not used again, as sour food is detrimental to poultry. This process of feeding to extend over three weeks, by which time the birds should be prime. If carried over a lengthier period the birds become stale, and will go off in condition. Do not feed grain of any description. Any small potatoes that are not used for the table can with advantage be added to the above meals if they are boiled and mashed.

Most people think that the fowl when fed in coops or crates for market puts on fat, but this is not the case. The greater part of the weight gained by coop feeding is made up of soft tender meat. There is, of course, a certain amount of fat as well as meat, but not more than is found in the ordinary well-fed steer used for butchering purposes.

When marketing birds crate them of an even condition. One or two birds in poor condition will affect detrimentally the value of the rest.

Turkeys to be fattened need not be confined in pens or coops, as the change may put them off their feed with accompanying loss of flesh. Start feeding gradually three weeks before the young birds are required, and give morning and mid-day mash as previously described, but in this case do not make it sticky or sloppy. Feed mash in "V" troughs, and give all that the birds will readily clean up, removing any left over. The evening meal should consist of wheat only, while water and shell grit should always be available.

Experiment with a few birds for home use, and you will conclude that the little extra attention involved will be amply compensated by the gain in weight and delicacy of your table poultry.

EDUCATION.

A prominent writer has said that the function of education is to give everyone the opportunity of becoming the best that it is in him to become.

Agriculture is an art which renders those who understand it rich, but renders those who do not understand it, however much they labour, to live in poverty.—"H.A.C. Journal."

THE RED LEGGED EARTH MITE.

L. J. NEWMAN, F.E.S.,
Entomologist.

This destructive pest has spread far and wide throughout the South-West, causing great damage to gardens and field crops. It is fortunately confined to the winter months, disappearing on the advent of dry weather. The eggs of this pest, however, can stand long periods of desiccation, dryness and heat. It is by means of this over-summering egg that the pest is carried over from October to May. These eggs are lodged in the soil amongst litter of all sorts, or are blown about the surface of the ground.

After the falling of the first winter rains in May they hatch, and we have the sudden appearance in plague form of this pest. The plants attacked are almost cosmopolitan, but oats, peas, potatoes, lucerne, and some species of clover are the main field crops attacked.

With the view of overcoming this pest the Entomological branch has carried out a large series of experiments during the past winter. The attempt was made to incorporate with some manure a mite-killing agent, and thus produce a combined mitecide and top-dressing fertiliser. The final result of the experiments gave the conclusion that a mixture of carbolic and superphosphate, or Thomas phosphate, effectively destroyed the mite. The proportions of this mixture are as follows:—1lb. of 15 per cent. carbolic powder to 3lbs. of superphosphate or Thomas phosphate. The ingredients should be thoroughly mixed and used as soon as possible. It is advisable to only mix sufficient for each day's requirements. The dust may be applied by hand or by means of a perforated tin; over large areas it can be applied by means of a super spreader, or by removing the tubes from the drill and allowing the powder to drop on to a sloping board. The main object is to get a good even distribution of the dusting powder over and around all infested plants. It is recommended that at least 1cwt. of the mixture be applied per acre of crop.

The time to apply the dusting is after 11 a.m. up to sundown on fine sunny days. The mite does not become active until the foliage has become dry. If the dust is applied to wet foliage it becomes inoperative to a large extent owing to its caking on the leaves. Being purely a contact method it is of little use applying same when the mites are not about. The carbolic is the killing agent, and is very fatal to the mite, as low as a 2½ per cent. causing great mortality. The formula recommended equals about 4 per cent. carbolic content. To use any stronger carbolic percentage is not recommended as same will burn many plants.

This mixture will not destroy the eggs.

It is therefore necessary to repeat the dusting operation after a period of eight to ten days, when the mites will have issued from the eggs, and be destroyed before another batch of eggs will have been laid.

The cost of the treatment, which is not excessive, is greatly offset by the extra returns received from an area so treated. By the use of this combined mixture a mitecide and fertiliser have been applied, with the one expenditure of labour and time.

If not desiring to use a manure basis, lime, tobacco dust, or any other inert dust may be used in the same proportions.

There are several firms in the city who supply this mixture in a ready to use form.

FRUIT PRODUCTION AND EXPORT FOR SEASON 1924-25.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

The Fruit Season of 1924-25, taking it on the whole, has been a successful one. The crop, while not so heavy as in the record year of 1923, was good, and prices, both at Home and abroad, were much better than in that season. The four principal kinds of fruit produced in Western Australia are—apples, grapes, oranges, and pears: the area devoted to production of these being:—apples, 9,672 acres; grapes, 5,235 acres; oranges and mandarins, 3,423 acres; pears, 1,308 acres; aggregating 19,638 acres, or four-fifths of the total area of 24,016 acres under fruit in the State. A strong demand for prime apples for export was consistently maintained throughout the season, prices ranging from 7s. to 10s. on rails at growers' sidings, and the returns to date show that those growers who decided to ship on consignment instead of selling direct to agents lost nothing by the action taken.

I have been interested in going through the account sales of various London fruit brokers and salesmen, whose catalogues are forwarded to this Department, to note how regularly throughout the past season Western Australian apples have topped the markets in competition with the Eastern States and New Zealand. As a matter of fact this same compliment has been paid to our apples by London buyers ever since the State commenced exporting in commercial quantities, and it is pleasing to find that though there may be, and no doubt are, improvements still to be effected in our methods of placing the fruit on the English market, at any rate we are not lagging behind, but are keeping more than abreast of, our Australasian competitors.

The bulk of the returns in the catalogues referred to showed prices ranging from 14s. to 20s. per case, with many fairly large consignments averaging 17s. 6d. to 18s. 6d. per case. Some little time ago the State Fruit Advisory Boards in several of the States worked out the cost of producing a bushel case of apples and placing same in season 1924 on the London market, when ocean freight was 4s. per bushel, the same as in the season under review. The total cost arrived at by each board was very nearly the same, and the Western Australian figures, which I quote hereunder, show that it takes 3s. 11d. to produce a bushel case of apples, and put it on the bench ready for packing, and a further outlay of 9s. 0⅜d. to place same on the English market, making a total outlay of 12s. 11⅜d. per case by the time the fruit reaches the buyer. A well-kept apple orchard in full bearing should produce 150 to 200 cases per acre, so it will be seen that the prices quoted above have allowed a fair margin of profit to the grower. The total quantity of apples shipped for year ending 30th June, 1925, amounted to 347,342 cases, and the estimated cost of producing and marketing in England one bushel case of apples is as follows:—

	s. d.
Cost of production (ready for packing) including interest on capital, of fruits exported overseas	3 11

	s.	d.
Cost of—		
(a) Case made up to bushel size	0	10
(b) Packing labour (including stencilling) ..	0	6
(c) Packing materials	0	3½
(d) Local cartage and freights to export wharf	0	7
(e) Any other charges—wharfage at port of export	0	2½
Export oversea charges—		
(a) Shipping charge	0	4
(b) Customs export inspection fee	0	0⅛
(c) Freight	4	0
(d) Insurance	0	1¾
(e) Consolidated charges (London)	1	1
(f) Selling brokers' commission	0	8
(g) Bank exchange	0	4
(h) Advertising fee (London)	0	0½
(i) Any other charges	—	
Making a total of ..	12	11⅜

Neither the local nor the English markets for grapes had a pleasing tale of satisfactory prices to unfold, and unfortunately this refers to both the fresh and dried product. Many consignments of fresh grapes opened up badly in England, and brought very low prices, while others which landed in good condition reached high prices. The case used for the major portion of the shipments was the three-quarter bushel flat, and the fruit was packed in granulated cork: the same case and method of packing has been used for a number of years, and our principal export variety—Ohanez—has usually opened up well under these conditions, but this year has been an exception, and a few small lots put up in trays, which landed in good order and sold well will, no doubt, cause growers to give the smaller packages a much bigger trial next year.

Part of the difficulty experienced with the grape crop was caused by an unusual—for Western Australia—summer rain, which did a considerable amount of damage to the currants and muscats while on the vines, and rendered drying operations difficult. The rain also had a bad affect on some of the table grapes, particularly those varieties which set berries closely together; the berries in the centre of these decaying and causing a great amount of extra labour in cutting out prior to packing.

The total quantity of fresh grapes exported for year ended 30th June, 1925, amounted to 25,974 cases.

Orange trees are not carrying as good a crop throughout the State this year as last, some districts being decidedly light, while others are from medium to good. Present indications point to a smaller quantity being exported this year than last, but some agents have bought small parcels for shipment at the satisfactory price to the grower of 10s. per bushel case on rails.

The total quantity exported for year ended 30th June, 1925, amounted to 12,580 cases, but the great majority of these were shipped during the last half of 1924.

There was a good crop of pears throughout the State in the 1924-25 season, and more than double last season's quantity was exported, but prices on the English market were very variable through some of the fruit arriving in bad order.

The total quantity exported for year ended 30th June, 1925, amounted to 16,886¾ cases.

Full particulars of the ports of shipment, number of cases, kinds of fruit and markets to which it was forwarded, are as follow:—

Export of Fresh Fruit from Western Australia for Year ending 30th June, 1925.

Destination.	Apples.	Grapes.	Pears.	Peaches.	Nectarines.	Plums.	Quinces.	Passion Fruit.
	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.
London	149,127	12,571	8,398¾	24	66	10	1	23
Do.	84,732	...	5,657½	...	...	...	...	...
Do.	29,813	...	738	...	...	...	...	...
Liverpool	10,249	620	75	...	...	...	...	...
Do.	8,245	...	...	...	...	...	...	...
Hull	8,189	255	223½	...	...	...	...	...
Do.	17,160	...	1,129	...	...	...	...	...
Port Said	4,089	...	...	...	...	...	...	...
Do.	500	...	...	...	...	...	...	...
Durban	297	...	...	...	...	...	...	...
Do.	1,197	...	...	...	...	...	...	...
Cape Town	1,375	...	...	...	...	...	...	...
Hamburg	1,044	...	...	...	...	...	...	...
Calcutta	85	...	...	...	...	...	...	...
Singapore	10,301	6,003	277¼	22	20	...	21	...
Batavia	4,277	498	256½	2	1	...	...	...
Samarang	642	196	31¾	5	...	5	...	...
Sourabaya	9,029	2,503	99½	38	10	5	4	...
Colombo	6,789	3,098	...	...	...	...	...	...
Mauritius	194	230	...	...	...	...	...	...
Tavoy	2	...	...	...	...	...	...	...
Banjoewangie ...	6	...	...	...	...	...	...	...
Totals	347,342	25,974	16,886¾	91	97	20	26	23

Destination.	Loquats.	Lemons.	Oranges.	Shipped from			Total.
				Albany.	Bunbury.	Fremantle.	
	cases.	cases.	cases.	cases.	cases.	cases.	cases.
London	...	...	8,240¾	...	...	178,461½	
Do.	...	...	...	90,389½	...	...	299,402
Do.	...	...	...	...	30,551	...	
Liverpool	...	...	...	...	...	10,944	19,189
Do.	...	...	...	8,245	...	...	
Hull	...	...	...	...	...	8,667½	26,956½
Do.	...	...	...	18,289	...	...	
Port Said	...	...	...	...	...	4,089	4,589
Do.	...	...	...	500	...	...	
Durban	...	...	...	297	...	...	1,494
Do.	...	...	...	...	...	1,197	
Cape Town	...	...	...	...	...	1,375	1,375
Hamburg	...	...	...	...	...	1,044	1,044
Calcutta	...	...	...	...	...	85	85
Singapore	¾	136¼	1,752½	...	...	18,533¾	18,533¾
Batavia	...	96¼	2,241	...	...	7,371¾	7,371¾
Samarang	...	6	31¼	...	...	917	917
Sourabaya	...	3¼	236½	...	...	11,928¾	11,928¾
Colombo	...	...	76¼	...	...	9,963¼	9,963¼
Mauritius	...	...	...	...	...	424	424
Tavoy	...	...	...	...	...	2	2
Banjoewangie ...	...	...	2	...	...	8	8
Totals	¾	242¼	12,580¼	117,720½	30,551	255,011½	403,283

It will be seen from the above that the fruit shippers are keen in seeking out overseas markets, and in addition to the places named Western Australian fruit was transhipped in England for Stockholm, Gothenberg, Cologne, and Copenhagen. The fame of the apples in the red cases has spread to Europe, for I was shown a cable from a firm in Stockholm asking to be put in touch with someone who could supply the apples in the red cases, and I know that satisfactory trade resulted.

PEPPERMINT IN WESTERN AUSTRALIA.

In our June issue we published a "Report on Four Years' Experimental Cultivation of Peppermint in Western Australia," by H. V. Marr, and readers of this "Journal" will be interested in the following extract from the "Perfumery and Essential Oil Record" which has been kindly supplied to us:—

"*Western Australian Peppermint Oil.*—Two samples of West Australian Peppermint Oil, 1923-24 and 1924-25 crops, have been submitted to us by Plaimar, Limited, Perth, Western Australia (agents Plaistowe & Company, Limited, London N.). They compare very favourably with the English variety in odour and flavour. Critically examined they are both slightly more aromatic; the older sample has acquired a more distinct bouquet or roundness than the other, and has no trace of that sense of bitterness to the taste that is sometimes developed in the ageing of peppermint oil. The aroma is particularly pleasant and the flavour not too pungent when cordials were prepared from them, which appeals as a distinct point in favour of the oil for confectionery and flavouring purposes. A few plain paste lozenges made and similarly compared with those from Mitcham oil could not be distinguished by several persons; to us, however, they were slightly more aromatic and not quite so strong—an agreeable difference in regard to its use for that class of work. Again the aroma would be distinctly favourable for perfumery use and for toilet-soap perfuming. An extemporaneous water made by agitating five drops with a pint of cold water is an excellent mouthwash for smokers, and with both samples so prepared the sense of freshness and cleanliness in the mouth was appreciably noticeable and lasting. An opportunity occurred for use in toothache; the older sample was tried on a plug of cotton wool, with gratifying result. Made up into essence and consumed with a little warm water and sugar in the usual way, one could obtain no opinions of any difference, indicating the close comparison with the best oil of peppermint obtainable."

CITRUS BROWN ROT.

W. M. CARNE, F.L.S.,
Botanist and Plant Pathologist.

Experiments conducted this season have demonstrated in a remarkable way the effectiveness of copper sprays in preventing the Brown Rot and the accompanying leaf blight of citrus trees. It has also been demonstrated that spraying for greatest effect must be done before the autumn rains commence.

Mr. A. C. R. Loaring, at Bickley, delayed spraying until after the first rains. The disease had broken out and continued for ten days or so after spraying, and then practically ceased. When inspected on the 21st of July less than one dozen affected fruits were found, and these were, with a few exceptions, above the sprayed portions of the trees. Adjoining orchards were all more or less affected, in one case very seriously, although only separated by a fence. In previous years Mr. Loarnig's orchard was the most seriously affected in the neighbourhood.

At Maddington Mr. Birrell's orchard suffered very severely last year, some of the lemon trees being entirely defoliated. The orchard was sprayed at the end of April, with the result that the trouble has been of no consequence this year. The defoliated lemon trees are recovering, though the effects of the disease last year prevented the trees fruiting this season.

At Pickering Brook spraying was delayed on Mr. Owen's orchard until after rain. The disease appeared, but has been of little consequence since spraying, though plentiful last year. The trees badly affected last year are recovering.

Mrs. Cross, of Roleystone, did not spray until June. On the 31st July only slight traces of the disease could be found except on one mandarin tree which had been accidentally missed in spraying. The unsprayed tree had lost about one-half of the leaves and nearly all the fruit.

Both Bordeaux and Burgundy mixtures have been used, and at different strengths, with equal effect. It is evident that weak solutions are quite sufficient. Bordeaux (4-4-50) or Burgundy (4-6-50) mixture, applied not later than the end of April, is recommended. In spraying, growers are advised to spray the trees thoroughly to about breast high. This has proved very effective on Mr. Loaring's orchard, and is preferable to spraying all over the trees. Trees sprayed all over are liable to increased scale infection owing, it is believed, to the destruction of fungi (not insect parasites), which tend to keep the scale insects in check. By partial spraying effective control of the disease is secured without destroying the useful fungi, and at the same time there is an economy of labour and spray material.

THE KITCHEN GARDEN.

G. N. LOWE,
Senior Potato Inspector.

RHUBARB.

This product, which is classed as a vegetable, actually takes the place of a fruit in household economy, and a very fine standby it is, being easily grown and giving a remarkable return when treated properly.

An instance called to mind is that of a gentleman who has planted roots of rhubarb in two large packing cases at his home, and from these plants supplies the needs of a small household. To obtain results of this kind, it is necessary, of course, to supply adequate fertiliser and water during the dry periods.

As rhubarb is a gross feeder a plentiful supply of stock manure and artificial is necessary, as few vegetables produce such immense growth of leaf, stalk, and root.

Trenching to a depth of two feet six inches by four feet wide is necessary, the number of "crowns" at a distance apart of three feet to determine the length of the trench.

When two or more rows are planted allow four feet to separate them.

After opening the trench as above, mix half the soil so removed with a similar bulk of well-rotted stock manure, to which should be added bone-dust and blood and bone to the quantity of two pounds to each barrow load as a rough guide. Replace this mixture in the trench to within 12 inches of the surface, including any garden refuse at the time which may be profitably turned to account in this manner. The top 12 inches, if of old garden soil and containing plant food from previous crops, will not need treating so heavily with fertiliser. New and poor soil, however, on the surface will be benefited by the inclusion of good rotted stock manure to the extent of one kerosene tin plus a double handful of high-class blood and bone to the square yard.

The winter crop—and "Topp's Winter" is a fine general purpose variety for this planting—should be planted in autumn after the bed has had some little time for sweetening and mellowing by atmospheric influence.

Summer growing varieties should be planted in July, August, September, and early October to become established thoroughly before the summer arives.

In planting rhubarb roots or "crowns," as they are more frequently designated, care should be taken that the top portion is not covered to a greater depth than 2½ inches, as there is a tendency to rotting at greater depths. Give the bed a thorough soaking after planting, and keep it moist at all times. Incidentally in all established garden beds, whether planted with vegetables or flowers, one good soaking is worth half a dozen light waterings, which only moisten the surface to evaporate as the sun appears.

Once the plants are established a plentiful application of liquid manure will be well repaid, and a mixture of one small handful of sulphate of ammonia or nitrate of soda, and a like quantity of superphosphate and sulphate of potash to a kerosene tin of water, should be watered in about 12 inches from each plant fortnightly. Keep the surface of the bed well worked, moist and free from weeds, which will be troublesome due to the good treatment of the bed with manures.

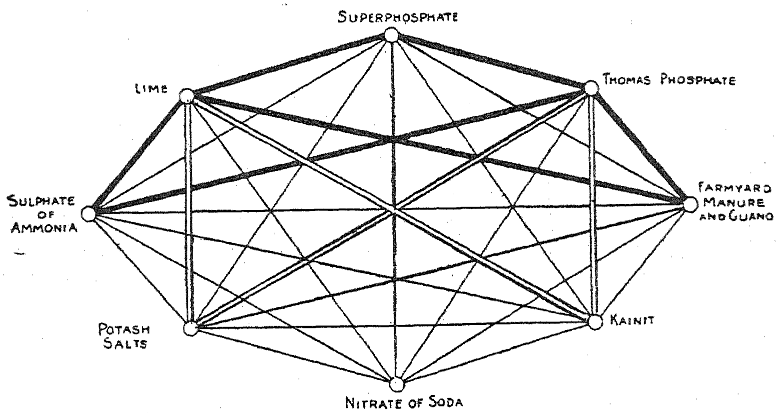
Householders are advised to obtain "crowns" for establishing their beds—rhubarb from seed is best left to the other fellow.

Every third year completely replant a bed as described, to ensure the maximum results.

In pulling the stalks leave sufficient to carry on the plant in full vigor, giving them a backwards and sideways pull till released from the plant.

HOW TO MIX FERTILISERS.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures.



Substances connected by thick line must not be mixed together.

Substances connected by double line must only be mixed immediately before use.

Substances connected by single thin line may be mixed together at any time.

VITICULTURAL NOTES.

H. K. JOHNS.

OCTOBER.

Cultivation should be well advanced in case dry weather should set in and the ground become too hard.

Weeds will now be growing strongly, and should be given no quarter.

Cultivators should be kept going in order to keep the soil in good tilth.

Where young vines have been planted out they should be watched, and in cases where the soil shows a disposition to cake they should be hoed and the soil well stirred up; provided this is done the vines will benefit by such culture rather than otherwise.

In various places misshapen and badly-formed vines have come under my notice, due mainly to want of proper care and attention during the early period of growth, and I strongly advise that careful attention should be applied to young vines in their second year. As soon as the buds start, or as soon as they have developed shoots of a few inches in length, the vines should be disbudded.

This consists of removing by hand all expect the two largest and best placed shoots, and this will give upright growth for formation of a permanent vine trunk. At times it will be found better to leave less developed buds than a shoot that, when it grows, will make a misshapen vine trunk and head. Vines at this period may make vigorous growth, but a large part of it is wasted unless disbudded and trained.

The more vigorous the vine the more careful the training required.

After this first disbudding it will be found that the two shoots left will grow rapidly, and when the growth is about twelve inches in length they should be carefully tied up loosely to a stake as a protection against winds.

Keep a sharp lookout for Cutworms amongst young vines, and also any grafted ones.

Black Spot (*Anthracnose*): If unseasonable weather prevails, such as wet weather with muggy, humid conditions, spraying with Spring Bordeaux Mixture should be applied, as per following formula:—

Copper Sulphate—6lbs.
Freshly burnt Lime—4lbs.
Water—40 gallons.

Odium.—Given suitable weather conditions this fungus will not doubt make its appearance, and the most successful treatment to be applied during the month is the dusting of the vines with Flowers of Sulphur, first applied when the shoots are in the vicinity of six to eight inches in length. If moist weather prevails applications of sulphur to be applied at intervals of eight to ten days. The sulphur should be dusted on in the early morning as far as possible. Do not make applications of sulphur when there is a sudden drop in the temperature, as the sulphur becomes more or less ineffective by failing to evaporate at a low temperature.

Cincturing.—Preparations for cincturing of currants, such as removal of outer rough bark, should be gone on with as spare time avails.

This will assist materially to expedite the work of cincturing, as it is necessary that it should be done as speedily as possible in order to check the flow of sap to the newly formed berry until such a time at it sets firmly on the bunch. Cincturing is carried out just at the time when the flowers on the bunch have started to die and fall, or when the berries are the size of small shot.

Cellar.—Do not leave unfortified wines on ullage.

Make a practice of filling up regularly, with a carefully selected, sound wine.

If hot weather prevails closely examine all young wines; more especially wines of a fruity nature that are unfortified, as they may need immediate attention.

NOVEMBER.

Summer is upon us once more with a lot to be done during this month. Keep one object in view in regard to cultivation, that is, a protective tilth to be maintained in the soil.

Always cultivate after each rain, and if none is forthcoming, cultivate at least once in every three weeks.

This is essential for conserving moisture. Young vines to be examined carefully and to be kept well hoed and soil well stirred up. The growing shoots will need a second tie as a preventive against damage by heavy winds, and when they have hardened up it will be found advisable to remove the weakest of the two; this enables the vine to concentrate all its energy to the growing and developing of good sound wood for young vine trunk formation. Grafted vines also require special attention and treatment as per my remarks on young vines.

Disbudding.—I find this important factor unfortunately is omitted in various vineyards. I strongly contend that it should receive just as much careful attention as pruning. Repeatedly I have noticed the energy of vine growth going to superfluous wood such as water shoots—nonproductive wood, consequently the fruit and wood for pruning for the following season is not receiving the full amount of plant food that it really should. Disbudding of unnecessary growths such as water shoots and non-fruiting wood, where not required for formation purposes, should be carried out, also pinching back or checking of growth to prevent their becoming unnecessarily long.

Cellar.—Closely examine young fruity unfortified wines; at first signs of sickness treat immediately. Keep all dry wines filled.

DECEMBER.

If long continued dry weather be experienced it will tell on all growths, and especially in the case of young vines, the soil of which should be kept thoroughly pulverised and free from weeds. Surface cultivation of the vineyard should be kept going in order to destroy all weeds and prevent the formation of a surface crust, which facilitates evaporation.

All the ordinary work should be completed by the end of this month.

Except in the event of rain and humid, muggy weather, sulphur dusting to be applied for Odium.

Cellar.—All dry wines to be kept filled, and if hot weather prevails, cellar to be kept as cool as possible.

MULCHING EXPERIMENT.

Chapman Experiment Farm, 1924.

I. THOMAS,
Superintendent Wheat Farm.

The object of this experiment is to determine how far and under what conditions the cultivation of winter fallowed land is profitable.

The soil on which the experiment was carried out is a red sandy loam, being typical of jam country. The plots were ploughed four inches deep with a mouldboard plough early in August, and were cultivated with a Springtyne cultivator when required for carrying out the experiment.

Plot No. 1 received a cultivation late in August, again in October, twice during February, once in April, and again prior to seeding. At planting time the ground was in excellent order and free from weeds.

Plot No. 2 received similar cultivation during August as Plot No. 1, but had no further cultivation until immediately before seeding. It was then in very fair condidtion, though not in the same tilth as was the case in Plot No. 1.

Plot No. 3 had no cultivation after ploughing until immediately before planting. At planting the tilth was rough. A little dead grass and other weeds were also present on the surface.

The seasonal rains commenced on the 11th May, and the planting of the experiment was done on the 13th under ideal conditions.

The variety of wheat sown was Nabawa, at the rate of 45lbs. per acre, with an application of 90lbs. of superphosphate (22 per cent.).

The area of each plot was half an acre, one-eighth of an acre being cut for hay and the remaining half-acre being left for grain.

The hay results obtained this year, together with the average yields to date, are shown in the table herewith:—

Mulching Experiment—Chapman Experiment Farm.

Variety, Nabawa. Seed, 45lbs. per acre. Superphosphate (22 per cent.), 90lbs. per acre.

No. of Plot.	Treatment.	Hay Yield.			
		Per acre, 1924.	Percen-age, 1924.	Per acre. Average, 1914-1924.	Percent age, 1914.
		cwts. qrs. lbs.		cwts. qrs. lbs.	—
1	Cultivated Aug., Feb., and April and prior to seeding	36 2 8	107	26 0 0	108
2	Cultivated Aug. and prior to seeding ...	34 0 24	100	24 0 16	100
3	Cultivated prior to seeding only	25 2 16	75	19 2 24	87

Before the plots reserved for grain could be harvested they were destroyed by fire, and no results were therefore obtained.

The results obtained this year confirm the conclusions and recommendations that have been made from previous results obtained each year since 1914, namely, that the general practice should be to cultivate the fallowed land in the spring and again prior to seeding, and that in cases where the ground is weedy this cultivation should be supplemented by additional cultivation after rain during summer.

Further, as shown by the results obtained at Merredin this year when the September rainfall was scanty, spring and summer cultivations not only destroy weed growth but also act as an insurance against a period of short rainfall.

MERREDIN EXPERIMENT FARM.

J. H. LANGFIELD,
Manager.

The mulching experiment has been carried out at this Farm each year since 1915. The land on which this experiment was planted is heavy forest country. The three plots required for the experiment were ploughed four inches deep with a heavy disc plough in June, and cultivated as required with a Springtyne cultivator, and were planted on the 22nd May with "Nabawa" wheat at the rate of 45lbs. per acre, with an application of 84lbs. of 22 per cent. superphosphate.

Plot No. 1 was cultivated in September, after rain (25 points or more) during summer, and again prior to planting. A perfect mulch was obtained and maintained throughout the fallow period.

Plot No. 2 was cultivated in September, but received no further treatment until seeding time, when it was worked down until a good seed bed was formed. Weeds grew and developed on this plot, and a considerable number of wild oats grew in patches.

Plot No. 3 was a "neglected" fallow, the ploughed land being uncultivated until seeding time, when it was also worked down to make a good seed bed. This plot was very weedy, it also "set" down, and became so hard that it was found necessary to cultivate it twice before a good seed bed was obtained.

The results obtained this year, together with the average yields to date, are shown hereunder:—

Mulching Experiment—Merredin Experiment Farm, 1924.

No. of Plot.	Treatment.	Grain Yield.			
		Per acre, 1924.	Percentage 1924.	Per acre. Average, 1915-1924.	Percentage, 1915-1924.
		Bush. lbs.	%		%
1	Mulched in Spring: after summer rains, and before planting ...	27 16	116	23 23	102
2	Mulched in spring and before planting ...	24 5	100	22 51	100
3	Neglected fallow cultivated before seeding only	25 20	105	21 47	95

No. of Plot.	Treatment.	Hay Yield.			
		Per acre, 1924.	Percentage, 1924.	Per acre. Average, 1915-1924.	Percentage, 1915-1924.
		cwts. qrs. lbs.	%	cwts. qrs. lbs.	%
1	Mulched in spring: after summer rains and before planting ...	50 2 24	109	51 2 0	104
2	Mulched in spring and before planting ...	46 2 16	100	49 2 8	100
3	Neglected fallow, cultivated before seeding only	45 2 8	98	49 1 20	100

THE GOSPEL OF THOUGHT.

The farmers might do well to ponder over what someone has said:—

"The mind that is full of the trifles of never-ending daily duties is not a good place for large ideas to originate and develop. The gospel of work is a good gospel to preach and to practise, but it is not the only good gospel. It pays to sit and think—not to lounge and dawdle, but to think with an active mind and a definite purpose."

WHEAT YIELD COMPETITION.

(No. 2 Zone.)

In our last issue, page 257, the average yield per acre of Mr. A. Elder's crop, Moulyinning was shown as 21 bushels 16 pounds. This was caused through a clerical error, and should read 21 bushels 34 pounds, and thus entitles Mr. Elder to one more point in the competition.—[Ed.]

PHOSPHATIC FERTILISERS AS MANURES FOR GRASS LAND.

A. B. Adams, Dipl. Agric.,
Agricultural Adviser, Dairy Branch.

The manuring of grass land has been carried out for a long period; at first chiefly with farmyard manure, when any could be spared from the arable land, and with the application restricted to the meadows, or grass lands, intended for hay; later, bones and bone ash were used.

The farmers of those days, like the farmers of more recent times, on using phosphatic manures wondered if they contained clover seed.

The fertilisation of grass land received a great impetus with the production of large quantities of basic slag as a waste product of the steel industry, obtainable at a very low price.

This fertiliser gave wonderful results in England and other parts of Europe; on many clay soils causing a growth of legumes (chiefly wild white clover) to such a marked extent that the farmer thought there must be clover seed present in the slag.

Actually there were clover plants present in the pasture before the manure was applied, but in such a dwarf form that they were only to be found after a very careful search.

Many of the results discussed in this paper were obtained by the use of slag, but it must be constantly remembered that the slag was used in most cases because it was the cheapest form of phosphatic fertiliser on the market, and not because it had given better results than other phosphatic manures. The general English practice has been to use a heavy dressing of slag, up to 10 cwt. per acre, and not give another application for about ten years.

By considering the results of manurial experiments and demonstrations which have been conducted in other countries over a comparatively long period, it is possible for us to learn something of the results to be expected, and of the factors involved in the results obtained.

The effects of topdressing permanent grass with phosphatic fertilisers may be classed under the following heads:—

(a) The increase in quantity of feed.
(b) The change in the botanical character of the herbage.
(c) The improvement in the quality, as distinct from the quantity of fodder, as shown by the increased production of meat and milk without any increase in bulk of feed produced.
(d) The improvement in the general health of the cattle.
(e) An improvement in the chemical and physical characteristics of the soil.

(a) *The increase in Quantity of Feed.*

An increased growth of herbage is one of the first and most striking results of the use of superphosphate on grass land, in the South-West of this State. It has been well and truthfully said that it does not so much

cause a difference as a contrast. This will be noted from the figures, and also from the illustrations with "Pastures—Top-dressing Experiments" by Mr. G. K. Baron-Hay (page 51 of the present volume). This contrast is only to be seen when the paddock is closed and is not depastured by stock. There are numerous cases reported where the manured portion of a paddock showed greatly increased growth until stock were turned in. The animals kept to the manured part, and left the unmanured part severely alone; consequently, after some time the unmanured portion appeared to have the greatest amount of feed.

From the results of the top-dressing experiments officially reported in this State last season, the growth was increased two and a-half times on the average.

In Victoria somewhat similar results have been obtained by cutting the grass crop, taking the average for that State and calling the yield of un-

manured grass 100, the use of 1 cwt. of superphosphate per acre gave 197, and the use of 2 cwt. 275, an increase of 97 per cent. and 175 per cent. respectively.

(b) *The Change in the Botanical Character of the Herbage.*

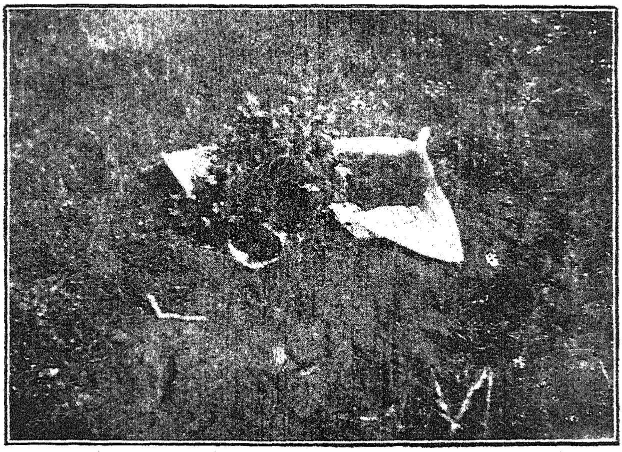
This change is most noticeable on land which has normally a thick growth of grass and miscellaneous herbage with but few clovers and trefoils present; it is a condition more common in Europe than in this State, but is occasionally noticeable here. Taking the average of the plots top-dressed last year, the percentage of leguminous plants present was increased from 26 per cent. on the unmanured, to 61 per cent. on the 1 cwt. superphosphate, and 71 per cent. on the 2 cwt. superphosphate plot.

(c) *The Improvement in the Quality of the Feed.*

Under our conditions the improvement of quality without any increase in quantity is very exceptional, as usually the application of fertliser results in a greatly increased growth of feed. This condition might be expected on some of the coastal soils rich in lime; soils which are naturally well grassed. At Quindalup, near Busselton, plots top-dressed in 1923 gave no apparent difference in amount of feed. Unfortunately it was impossible at that time to determine experimentally the increased feeding value of the manured plots, but knowing the increased carrying capacity of somewhat similar land in the vicinity when top-dressed, one would think that parallel results to those in other countries would have been obtained. At Cockle Park, Northumberland, England, basic slag applied to the soil on Tree Field not merely gave an increased quantity of mutton and hay, but almost doubled the proportion of phosphoric acid in the hay, so that the amount of phosphoric acid consumed per acre by the animals was quadrupled by the addition of phosphatic manures. It has been found that a manured field when mown gave little if any increase in weight of hay, but when grazed it gave a big increase in mutton as compared with the unmanured portion.

(d) *Improvement in Health of Cattle.*

One of the most important results from the use of phosphatic fertilisers is the distinct improvement in the health of the live stock. A sufficiency of phosphates in the diet is absolutely essential to health. On a phosphorus deficient pasture, cattle become unthrifty, and commence bone-chewing with all its attendant evils.



Bone-chewing is an indication of an acute shortage.

A slight deficiency, though injurious, is not so noticeable to the ordinary observer.

Sheep under similar conditions do not thrive or hold their condition as they should do, and it will be noticed that the stock-carrying capacity of the holding declines in spite of the fact that there does not appear to be any actual shortage of feed.

Mature horses will probably not show any marked ill-effects, but it will be found impossible to rear foals or young horses with good bone and limbs, on markedly deficient soils; they will develop crooked limbs and swollen joints. Breeding and milking animals, having the greatest call on phosphates, are those that will suffer the first. Professor Somerville (Jour. Brit. Board of Agri., Feb., 1918) says, "the improvement was also reflected in the health of the stock. The mortality on the ewes in 1911 (when the experiment commenced) was 15 per cent., and in 1917 it was only four per cent."

(e) *The Improvement of the Soil.*

The changed character of the soil after a period of phosphatic fertilisation can be grouped under two heads:—

(1) Chemical.

(2) Physical or mechanical.

The chemical change is due to the residues of the fertilisers remaining in the soil, and as the phosphates when in contact with the soil are but very slightly soluble, practically the whole of the phosphate applied, which has not been sold off the farm in the form of animal or plant products, remains in the top foot of soil. At Woburn it was found that the whole of the phosphate, applied over a series of years, which had not been sold off in the crop, remained in the top nine inches of soil. This is, of course, an increase of plant food directly due to the farmer's application of fertiliser.

There is another very important increase, that of nitrogen. The increased growth of the leguminous plants, *i.e.*, those belonging to the pea, bean, and clover family, causes an increase in the amount of nitrogen present in the soil. It is now common knowledge that the plants of this family have the faculty of obtaining nitrogen from the air by means of the bacteria on their roots, and the whole of this, with the exception of that sold off in crops, etc., is returned to the soil. Soluble nitrogen is easily washed out of the soil.

Much of the increased supply of nitrogen, however, is present in the soil in the form of humus from root and stem residues and animal droppings.

Most of the nitrogen in this form is not immediately soluble, a small percentage under favourable conditions being constantly rendered soluble and available to the growing plants by the action of the soil bacteria. When the land is under permanent grass, the loss of nitrogen in drainage water is not as great as on arable land, because there are generally plants present to make use of the nitrogen as it is rendered available; consequently, grass land regularly fertilised with phosphatic manures alone, will have a steadily increasing nitrogen content.

This accumulation of organic matter is apt to cause an increasing acid reaction in the soil. At Cockle Park it was found that the soil became more acid after heavy dressings of slag, due to the increased amount of humus in the soil, and the clovers tended to decrease.

There was a marked improvement after the next application of slag. As the plot that was receiving lime also tended to lose clover, it would ap-

pear that P_2O_5 is the limiting factor and not acidity. It is probably of no use to use either lime or potash until the demand for phosphoric acid has been satisfied.

(2) Physical or Mechanical Changes.

The mechanical effect on the soil is almost entirely due to the increased root-growth penetrating deeper into the soil and the accumulation of humus. At Cockle Park where phosphates are used in large quantities the roots break up the soil and convert a very indifferent clay into a fair loam. These results follow from the changed bacterial and fungoid decompositions of organic matter in the soil, which are induced by the kind of fertilisers applied to the field. On the unmanured plot yellow clay still remains close to the surface, yet on the plot that has been manured for over twenty years with basic slag a very useful loam soil extends to 10 or 12 inches from the surface.

(To be continued.)

ERRATUM.

In the June issue, the last paragraph of Mr. Adams article on "Phosphatic Fertilisers as Manure for Grass Lands," page 176, should have read, "on the Abba River Groups, basic superphosphate gave very much better results than basic slag, and the use of the latter is not advised under West Australian conditions, unless experiment has proved it the best fertiliser for some particular soil."

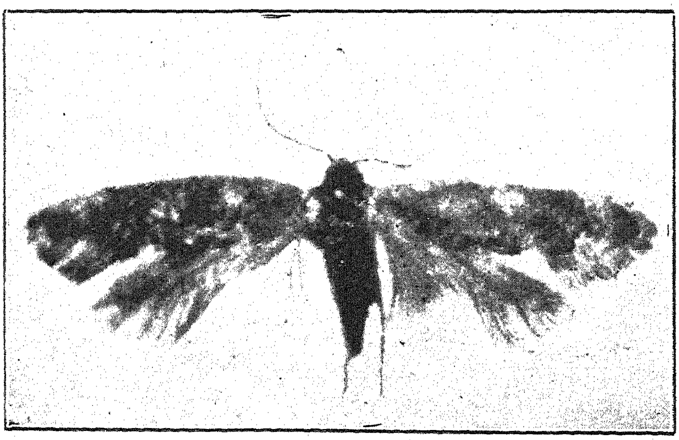
THE JARRAH LEAF MINER.

(*Tinea sp.*)

L. J. NEWMAN, F.E.S., Entomologist
and
J. CLARK, F.L.S., Assistant Entomologist.

During the past four years this destructive Lepidopterous insect has caused great damage to the foliage of the Jarrah (*Eucalyptus marginata*). It is also equally bad in its attack on the Swamp Gum (*Eucalyptus rudis*), and is more or less found to be accidently attacking the leaves of the Tuart (*Eucalyptus gomphocephala*), when growing amongst jarrah.

Fortunately the ravages of the larvæ of this moth are so far confined to the coastal jarrah growing on the plain country. Curiously the outbreaks are mainly found in proximity to the ports of Fremantle, Bunbury, Busselton, and Albany. From these centres it radiates in all directions inland for several miles to the base of the foothills. From Albany it has travelled some miles up the Kalgan and King River areas and westward as far as Torbay. Between Torbay and westward to Busselton the country is free from this moth. With the exception of some of the land in the Albany area, which is ironstone and granite, the area infested is of a sandy nature. Although close inspection and observation have been made of the commercial hill-grown jarrah areas, no evidence of the presence of this pest has

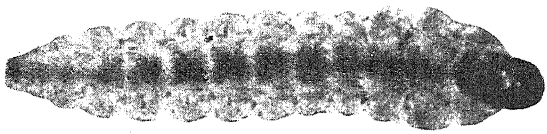


Jarrah Leaf Miner Moth (*Tinea sp.*).

been noted. The fact of its being found mainly in proximity to the various ports might suggest to some the possibility of its being an introduced species. Evidence is against this, as the same insect has been found as far inland as Merredin and Westonia in mild form on *Eucalyptus salubris* and *Eucalyptus transcontinentalis*. Further, the fact that it confines its attention to *Eucalyptus* is strong evidence that it is of local origin.

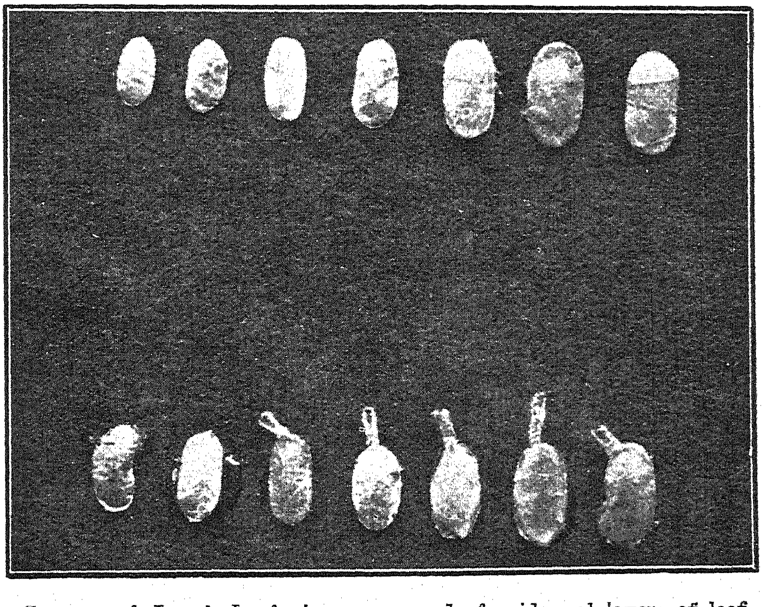
This Microlepidopteron first attracted our serious attention during the year 1920 by its work on the leaves of jarrah at King's Park, Perth, and Claremont. Casual outbreaks had been noted as far back as 1914.

The leaves of attacked trees were observed to be full of small oval holes and to have been denuded of their chlorophyll or green contents, having the appearance of being scorched by fire. Closer observation and critical examination revealed mines in the leaves inhabited by tiny lepidopterous larvæ. Upon collecting and submitting this material to cage incubation we were rewarded by the emergence of a small and insignificant moth. This moth has proved to be an unnamed and unrecorded species belonging to the Micro-lepidoptera of the Genus Tinea. The mines made by these caterpillars are



Larva of Jarrah Leaf Miner.

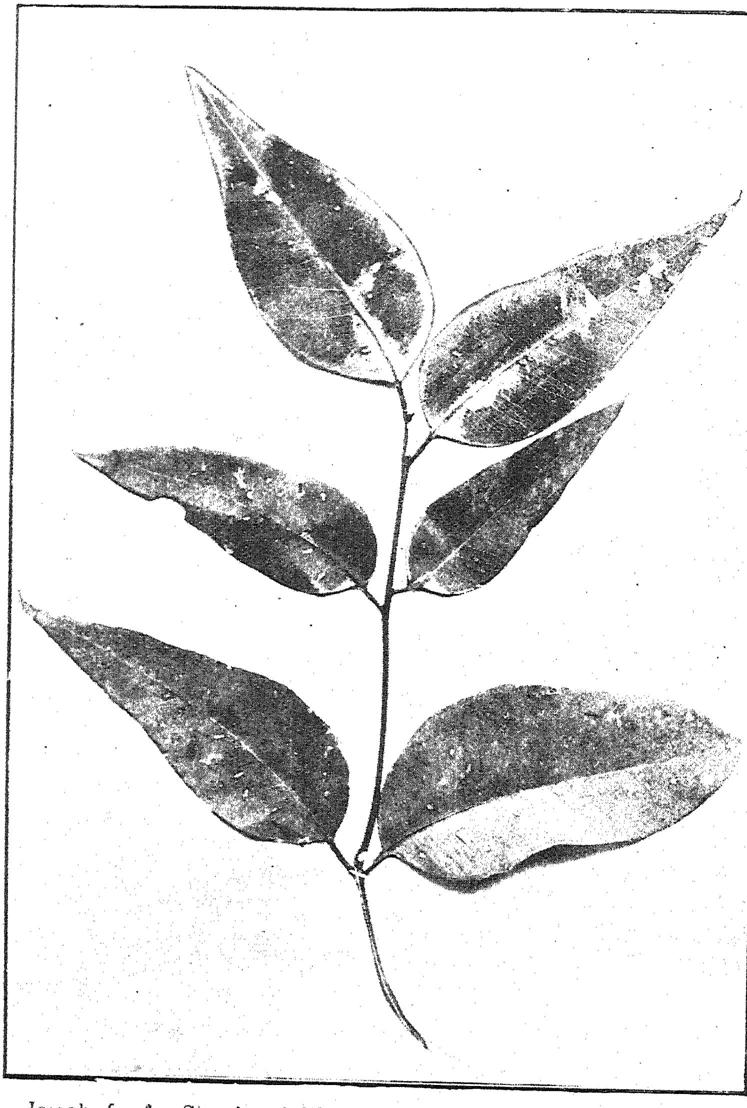
irregular and blotch-like, extending in many instances to all parts of the leaf. They are visible on both sides of the leaf, appearing as reddish-brown blotches, filled with the excreta of the mining larvæ. The number of mines in a leaf may vary from 10 to 50. Leaves on all parts and sides of the tree are attacked, but a preference is shown for those nearest the ground, young saplings and suckers being those most seriously affected.



Cocoons of Jarrah Leaf-miner, composed of epidermal layers of leaf which are cut out by larvae and fall to ground, producing typical oval holes in foliage; also pupae casts of moths as left when issuing. (Original)

The danger from this pest lies in the possibility of its extension to our prime and commercial jarrah areas. The question to be determined is what

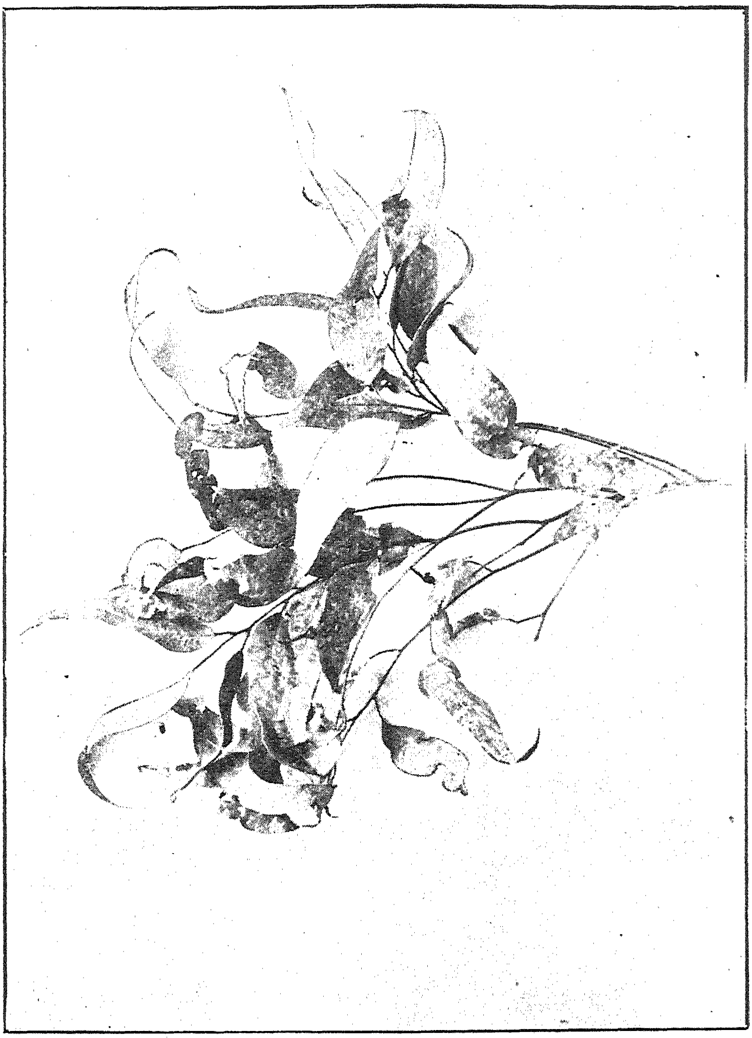
actual damage is done to the trees by this temporary defoliation. It is an accepted fact that the loss of foliage deranges the vital functions of tree growth, but to what extent and how may not be so clear. Any influence which checks the growth of timber may be accepted as an economic loss.



Jarrah Leaf. Showing initial stages of leaf-miner. Note spots.
(Original)

The damage by the Jarrah Leaf Miner is temporary as far as the foliage is concerned, and is during the non-growing period of the Eucalyptus, namely, May and June. Any foliage put forth after June is not affected by this leaf miner as the egg-laying moths have all disappeared. It is only

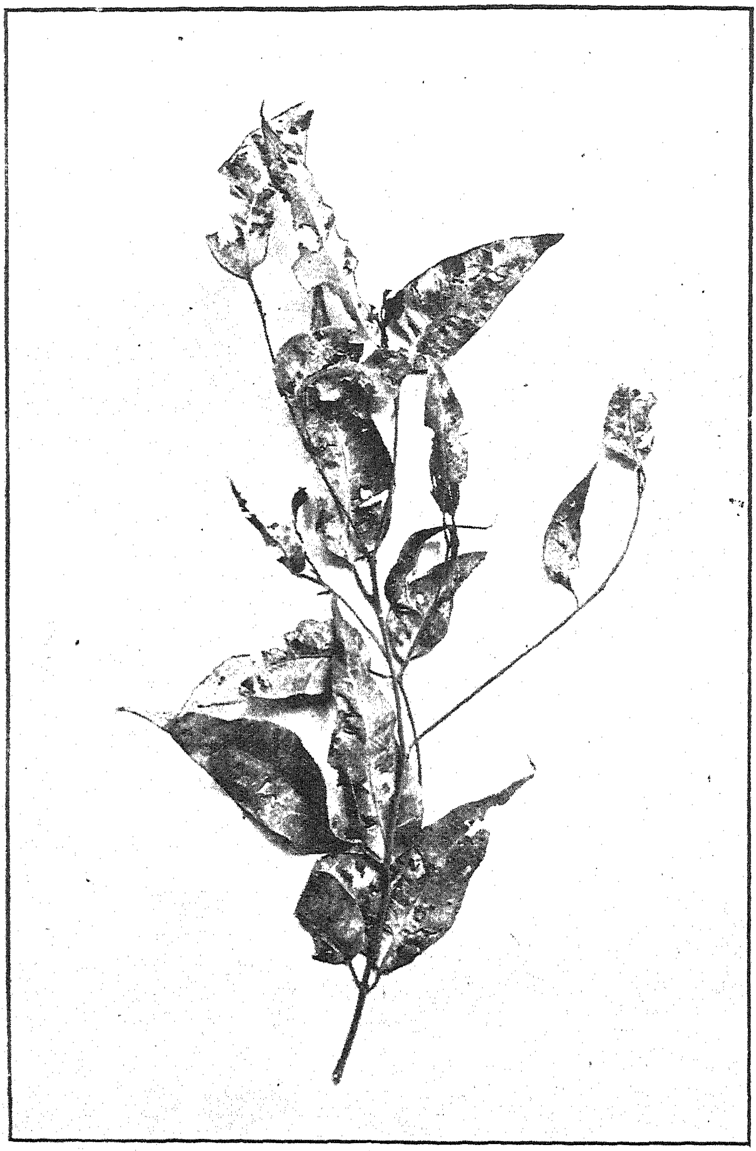
those leaves present on the trees at the time of the issue of the moths in May and June that are attacked. The larvæ do not travel from leaf to leaf, but live in the one mine throughout their life, from May to September. The fact that it attacks the trees at this period, when little growth is being made, is the reason for the dead appearance of the foliage so typical of the presence of this pest. In fact, at a distance, no new growth being made, it looks as if the forest had been severely burned, the leaves appearing all



Jarrah Leaves. Showing second stage of development of leaf-miner. (Original)

brown and dry. In any case, even though the defoliation is temporary, there must be a loss from delayed growth during the months of June, July, and August. In September the trees begin to make fresh foliage, and by the end of the year appear outwardly little the worse for the attack.

It would be of considerable interest to have this point determined as it is the factor which decides the seriousness or otherwise of this insect attack on the foliage. It is fortunate that this moth is single-brooded, otherwise



Jarrah Leaves. Showing third stage of development of leaf-miner.
(Original)

repeated attacks would soon cause the death of the trees. The worst check appears to be to the young seedling and sucker trees, the moth attacking those leaves nearest the ground.

Control.—Owing to the habits of this pest little can be done in the way of control by means of spraying. The eggs are securely deposited under the skin. The resultant caterpillars hatched from these eggs do not come to the

Jarrah Leaves. Final stages of development of leaf-miner.
Note typical holes in the leaf.

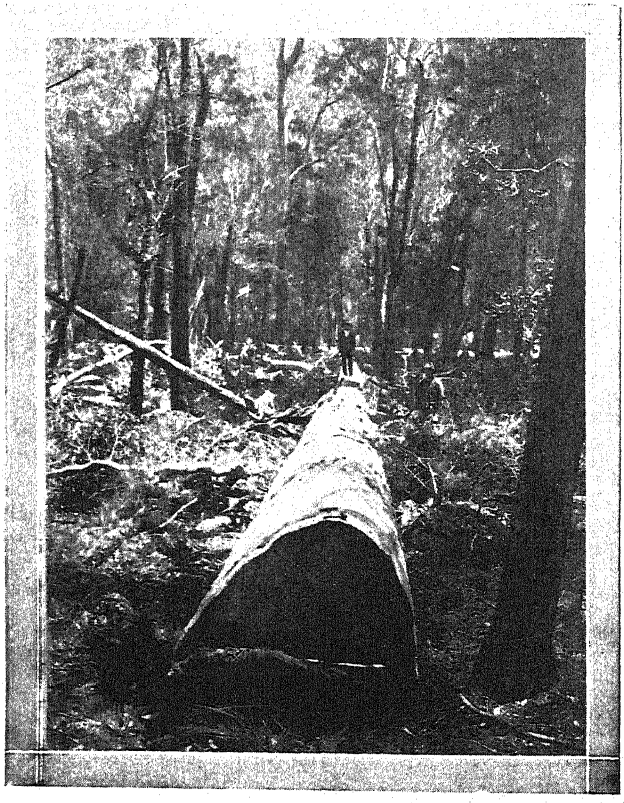
(Original)

surface of the leaf to feed. They commence operations from the point within the leaf where the egg was deposited, and continue within the leaf

until full grown. It is, therefore, obvious that the effective application of any poisonous or contact spray is out of the question. It is possible to poison the adults by the application of some sweetened attractive poison bait to the foliage, but this is not practicable owing to the size of the trees infested, and the large area that would have to be so treated.

The habit of the larvæ of burying themselves in the soil, just below the surface, renders them liable to destruction in large numbers by the application of fire to the bush. The fire passing over the surface of the ground roasts the hibernating larvæ. This method has the strong objection raised against it, in that fire causes great damage to young seedling and growing trees. The burning over with slow fires could be done with good effect in non-commercial jarrah or flooded gum country.

Natural Control.—To date we have failed to breed out or locate any effective internal or predaceous parasites.



A Fallen Giant.

SUDAN GRASS POISONING.

T. MURRAY-JONES, C.V.O.

Cases of mortality in stock have occurred from time to time, both in horses and cattle, the cause of which has been attributed to the ingestion of Sudan Grass when eaten before reaching the "heading" stage. However, as far as I know or can ascertain, the evidence in each case has been insufficient to warrant condemnation of this variety of valuable fodder as a potential danger.

It is recognised that Sorghum, to which this grass is allied, develops during its development stage, up to heading, a cyanogenetic glucoside which yield on fermentation Glucose, Acetone and Hyrocyanic Acid, but according to Mr. Carne, Government Botanist, the amount is so infinitesimal that it may be grazed at any stage without danger. Mr. Carne has, however, pointed out that there may be times when there is a possible element of danger from poisoning, *i.e.*—

1. When the plant is stunted or slow growing.
2. When the crop is not pure but contains hybrids, between Sudan Grass and Sorghum. These may be recognised by the thicker stems and broad leaves, and when in flower by the more compact heads.

There is no danger of poisoning—

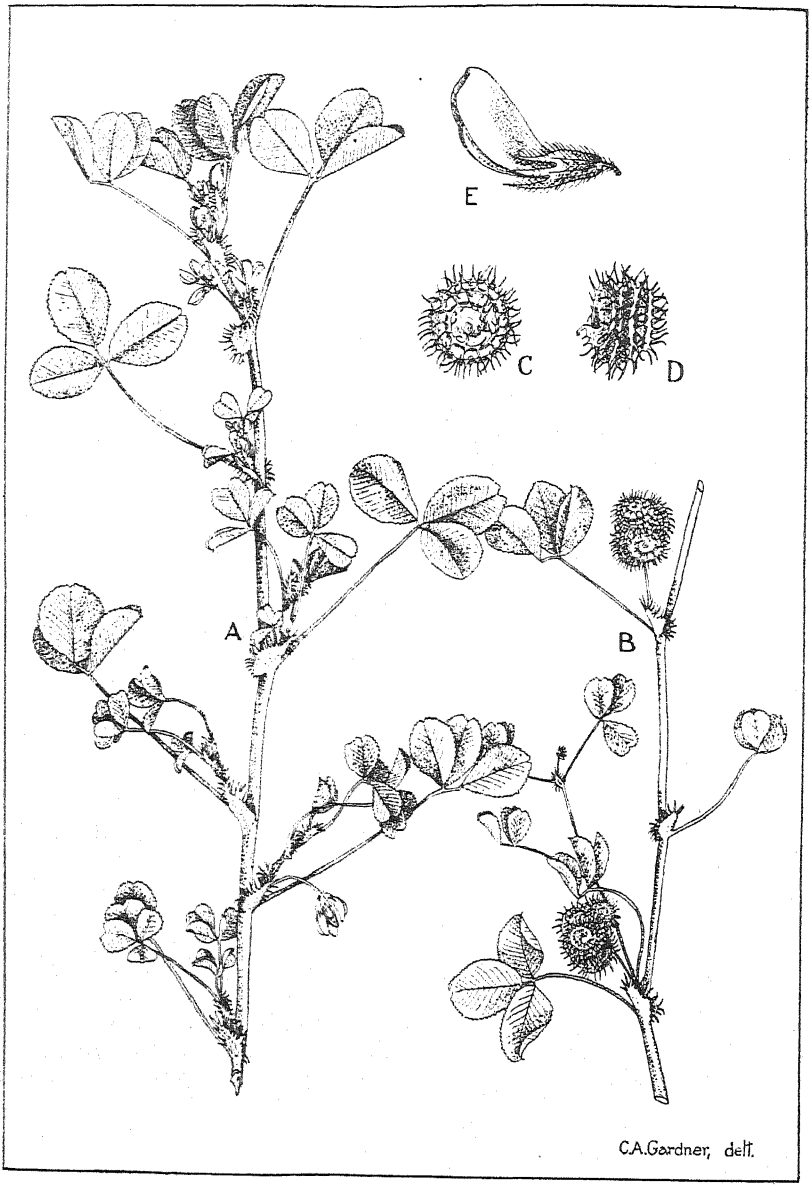
1. When the plants have headed.
2. When cut and wilted in the sun the day before feeding.
3. When made into hay or ensilage.

Cases have been investigated in Eastern Australia where prussic acid poisoning has been traced to the presence of Sudan-Sorghum hybrids. Other cases of supposed poisoning have been definitely put down to digestive troubles, when stock have been injudicially turned on to succulent Sudan Grass.

That stock are found to have died after ingesting silage (Sudan Grass) can only be admitted as *prima facie* and not conclusive evidence that the plant so ingested was of a poisonous character. Other factors that enter for primary exclusion are mechanical effects of a digestive origin—Toximes of a bacterial origin, *i.e.*, Botulism, or commonly referred to as forage poisoning, etc.

In the light of recent investigation in New South Wales the evidence suggests that the plants responsible for deaths were those of young Sorghum and a hybrid variety resulting from crossing Sorghum with Sudan Grass, and not to clean bred Sudan.

The point for stock owners and others interested in the growing of Sudan Grass is to make certain that they are growing from pure Sudan seed, and not of the hybrid or cross-bred variety. The Government Botanist will be pleased to supply information that will enable differentiation between the seeds to be made.



BURR TREFOIL.

(*Medicago denticulata,* Willd.)

A. Plant in flower. B. Plant in fruit. C. Burr (pod) seen from above. D. Burr seen from the side. E. Flower.

(A and B rather less than natural size, C, D, and E slightly enlarged.)

TREFOIL, OR BURR TREFOIL.

(*Medicago denticulata, Willd.*)

W. M. CARNE, C. A. GARDNER, and A. B. ADAMS.

Burr Trefoil is one of the hardiest of our annual introduced leguminous plants, and probably the most valuable pasture legume in the areas which have a low rainfall. This plant in order to thrive requires short winters, and temperatures which are not too low. It prefers heavy soils, and requires at least a mean temperature of 52 degrees F. in September and 60 degrees F. in October.

Burr Trefoil is often called "Burr-clover," a name which is misleading, for it is not a true clover, differing from the clovers in its large spiral spiny burr-like pod, and large-toothed or fringed stipules (outgowths at the base of the leaf-stalk).

The name Medicago is from the Latin *medica*, meaning lucerne, because lucerne was believed to have been introduced into Europe from ancient Media (Northern Mesopotamia). The name *denticulata* refers to the teeth of the leaves or stipules.

Burr Trefoil is naturalised as a common plant in cultivations and waste lands of the South-West districts. It is most common and grows most vigorously on the richest soils, and in gardens and orchards which have been well fertilised, particularly those which have received stable manure. In such places it forms an excellent green manure crop, the plants being turned in while green and tender; if left until maturity the tough stems make ploughing difficult, and may remain in the soil for a long period without decaying, thus making subsequent cultivation difficult, and choking the implements.

Germination takes place during the autumn after the first general rains, and the plant produces seeds during September and October. It is thus one of the earliest of the annual legumes.

Burr Trefoil is an excellent plant for the warmer and drier districts, because it succeeds where the more palatable clovers will not thrive, and its temperature requirements are better suited to the Wheat Belt and Northern districts than to the colder South-West. In the former it thrives in the open paddocks with suitable treatment, but in the South-West districts it requires shelter. Here it is not well adapted to pasture as it is readily eaten out. If eaten short it does not seed, unlike the cluster and drooping-flowered clovers, which manage to mature seeds even when closely grazed.

In the Midland, Victoria, Northern, and Central districts it is the most valuable of the leguminous pasture plants, developing best on soils in which superphosphate has been previously used. It prefers the heavier soils and responds well to top-dressing with one to two cwts. of superphosphate. At Gingin it also succeeds on the limestone hills.

Burr Trefoil is readily eaten by stock when young, but when vigorous and rank it is not liked. When in seed it is also readily eaten. Where it has made good growth it leaves large quantities of burr, which will keep sheep in good condition months after the plants themselves have disappeared. These burrs are objectionable in wool, but in the Victoria, Kellerberrin, and similar districts the advantages of the plant counteract this disadvantage.

The scattering of a few lbs. of seed is worth while where the plant is not common, but as a rule sheep can be depended upon to distribute the seed.

Description of Plant.—An annual with decumbent or prostrate stems; stipules bordered with fine teeth; leaflets obovate-cuneate, toothed at the ends, always hairless on the upper surface. Flowers small, yellow, usually two to eight together on axillary stalks, mostly shorter than the leaves; calyx-teeth as long as, or longer than the tube; standard longer than the wings and keel.

Pod hairless, disc-like or shortly cylindrical, green or brown when ripe, flat at both ends, with 1½ to 3½ coils pressing rather loosely upon each other, about ¼in. diameter without the spines, which are in two rows, slender and mostly hooked at the tips. Seeds three to six in each pod, light yellow and smooth, somewhat kidney-shaped, about ⅛in. long.

WINTER TRAPPING OF FRUIT-FLY.

(*Ceratitis capitata.*)

L. J. NEWMAN,
Entomologist.

To further prove the oft repeated statements of this Office, that the Fruit-fly does not hibernate throughout the winter months, a series of trapping experiments were undertaken. The period covered by the test was from the 5th May, 1925, to the 31st August, 1925, roughly four months. This covers our normal winter, when many people believe the fly to be in hibernation.

This phase of the life history of the Fruit-fly under our winter conditions, as the experimental tests have shown, is so comparatively brief that the term "hibernation" is not correct. What really does happen is a lengthening of the various life stages, but not sufficiently protracted to merit the term "hibernation."

The comparatively small difference between the summer and winter periods of the fly is due to the fact that the relative difference between summer and winter is not great; our winter climate being sufficiently mild to nuture a winter brood. These winter flies are dependent upon winter fruits, such as loquats, oranges, etc., to lay into.

What is demonstrated by these trapping experiments is the need for taking advantage of all fine spells during winter to foliage bait, and in small areas to trap these winter flies. By so doing the carry over of the pest must be reduced.

The following are the monthly totals of males and females captured:—

Month.	No. of Traps.	Males.	Females.	Total.
May	8	154	923	1,077
June	8	79	1,861	1,940
July	8	2	344	346
August	8	1	65	66
Total	...	236	3,193	3,429

The grand total of flies captured was 3,429, of which 3,193 were egg-laden females.

It will also be observed that the males died off rapidly after May.

HOP CLOVER.

(*Trifolium procumbens*, Linn.)

A. Plant (slightly reduced). B. Branch (natural size). C. Flower-head. D. Flower (enlarged). E. Pod, enclosed in flower, and seed (enlarged).

HOP CLOVER.

(*Trifolium procumbens.*)

W. M. CARNE, F.L.S., and C. A. GARDNER.

Hop Clover is one of the common naturalised clovers of the South-West, and together with *T. dubium,* Suckling Clover, is the hardiest and most widespread of the true wild annual clovers in South-Western Australia. The true clovers have all three leaflets, and can be distinguished from some so-called clovers by the pod, which is enclosed in the calyx, or small green cup which envelopes the flower while in bud. The closely allied Medicago species (trefoils) can be distinguished from clovers by the larger curved or coiled pod, often spiny, and the usually toothed stipules.

Where hop clover occurs in uncultivated land, the plants are usually very small. It makes a strong growth in cultivated land, but is always characterised by the wiry branches lying on the ground.

Hop clover succeeds well on light and sandy poor soils, where sometimes it forms a large proportion of the pasture during the spring. In the South-West and Great Southern districts it is not considered worth sowing, being usually present in most cleared places and when dry it is tough and wiry, stock leaving it for more appetising feed, but when young it is eaten by sheep, and palatable.

The plants germinate during June and July, and mature between the end of September and December, according to season and locality. Although the plant is frequently regarded as a native clover it is an exotic, native to Europe and Western Asia.

Description of Plant.—A low trailing annual plant, usually lying on the surface of the ground. Leaflets almost reversed egg-shaped or wedge-shaped, rounded at the apex, blunt and often indented, usually without any hairs; finely and rather prominently veined; the central leaflet on a short special stalk. Stipules (at the base of the leaf-stalk) broad and pointed, but much shorter than the stalk.

Flowers yellow on short stalks, numerous in an egg-shaped head; the calyx-teeth very unequal—the two upper ones very short, the three lower ones long and pointed. Standard (large petal) widely spoon-shaped, furrowed, withering to a brown colour, and folding downwards over the other petals.

Fruiting-heads cylindrical, hop-like from the papery standards which alone are prominent. The small pod is one-seeded, and enclosed within the withered flowers. The seeds are almost globular, yellow, and very small.

Flowering season August to November.

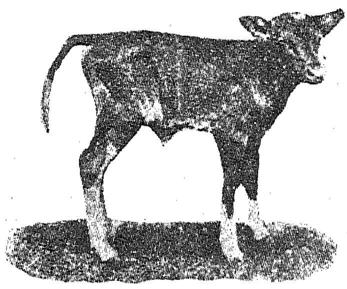
REARING DAIRY HEIFERS.

Their Value to the West Australian Dairying Industry.

P. G. HAMPSHIRE,
Dairy Expert.

There is no more important subject in regard to the establishment of the Dairying Industry in Western Australia than the proper rearing of all good type dairy heifers. The need of heifers to build up the average small dairy herds of Western Australia, and to stock the group settlement dairy farms, is of paramount importance, and no greater problem confronts the dairying industry of this State at the present time than the securing of large numbers of well-reared dairy heifers. Without doubt, the place where one would expect to find such heifers to be reared is on the dairy farms and cattle-raising country of the South-West, but it is becoming increasingly difficult to secure large numbers of these well-grown dairy-type heifers. As one travels the Great Southern, Midland, and adjacent wheat-belt country it is evident that a considerable number of good dairy heifers could be drawn from these districts, as almost every farmer has a few cows, while many, owing to the late high price of wire netting necessary for sheep-proof fences, carry a considerable number of young cattle which are heifers, but in many instances they do not receive the attention necessary to build up into good cows.

In the districts referred to the farmers are well advised to aim at "calving down" about May or June. This ensures that there will be green feed available during the greater part of the cows' lactation period, and provides pasture from which the young heifers can obtain the roughage they need. If paddocks with suitable pasture are not available for the young heifers, a supply of good hay should be made available in racks, which allows the young stock to eat at will, with the least amount of loss.



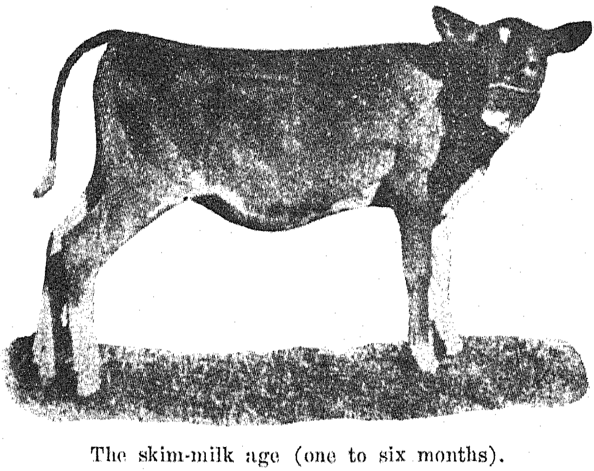
The delicate age (first four weeks).

All the well-reared dairy heifers in Western Australia are of great economic value to the State, and are prospective West Australian cows which are slowly but surely going to displace the thousands of Eastern Australian cows which are being milked daily to supply us with the dairy products that we import. There are, however, far too many poorly bred, underfed, badly-nourished, undersized, miserable specimens of dairy stock being

raised, which are not only unprofitable to the stock-raiser but a distinct menace to the successful establishment of the dairying industry. This type of badly-reared heifers invariably brings low prices, and, owing to cheapness, ultimately gravitates to the poorer struggling dairy farmer who is battling to get a herd together, and really becomes an additional mill-stone around his neck.

A dairy cow to be a profitable milk producer must be capable of consuming large quantities of suitable fodder over and above her daily maintenance ration, and the most profitable producer is one which can convert food, *over maintenance*, into milk. A good cow, therefore, must have a large capacity and her digestive organs become abnormally developed. The heifer, therefore, should be reared on the lines of building up a large, strong, healthy frame capable of performing the great functions required of her when she becomes a producer. If a heifer is badly reared, especially when wrongly or insufficiently fed, her frame and constitution suffers and her digestive organs do not grow but remain undersized. The majority of stunted, weak-constitutioned young stock so often seen are the result of the lack of protein foods, namely, foods such as bran, crushed oats, lucerne, clover and peas.

The great majority of young dairy cows which are unsuitable are the result of neglect between "weaning" and "breeding" ages, and even right up to springing are many simply turned out to "bush" and allowed to fend for themselves on unsuitable and insufficient feed. The average bush feed sadly lacks protein food, and contains an abundance of indigestible fibre.



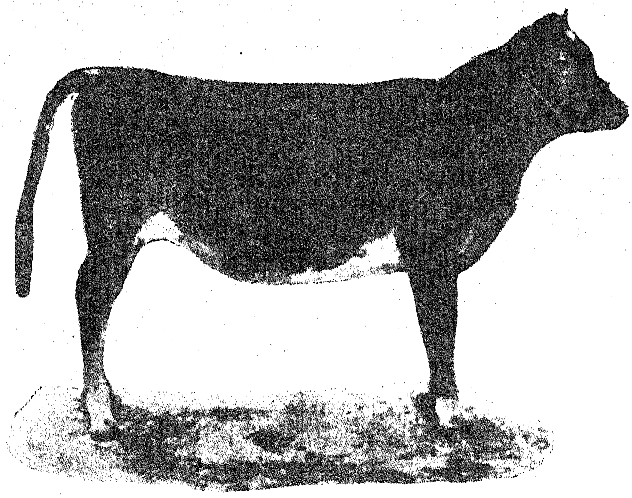
The skim-milk age (one to six months).

With the development of group settlements everything points to a constant demand in this State for large numbers of well-grown dairy-type heifers, for many years to come, at reasonable prices to the breeders, but the prevalence of many undesirable heifers has inspired the writer to offer advice on the proper rearing, and, at the same time, to urge the breeding and rearing of dairy heifers in Western Australia. It is, without doubt, desirable that young heifers should be well bred, and, as such, they would command higher prices than poorly-bred animals, but nevertheless, in view

of the necessity of many more dairy cows in Western Australia, it is highly desirable that all heifers be raised to a productive age. The improved "dairy" breeding will be obtained from their progeny by reason of the Government's policy of the use of pure "tested" dairy sires.

In outlining the rearing of dairy heifers it is recommended that the calf should be taken from the mother within a few days after birth. This is better for both, as it will make it easier for the mother and will avoid her fretting unduly, and the calf will learn to drink quicker than if allowed to remain on the dam over long.

It is important that the calf should receive its mother's milk for the first week at least. The "colostrum" or first milk of the cow is of special advantage and a necessity to the calf's digestive system, it having a cleansing and laxative effect on the stomach and bowels. Whole milk-feeding should continue for another week or fortnight, thence a gradual reduction in the whole milk should take place and the difference be made up with skim milk until, at the end of about one month or five weeks, the calf will be receiving



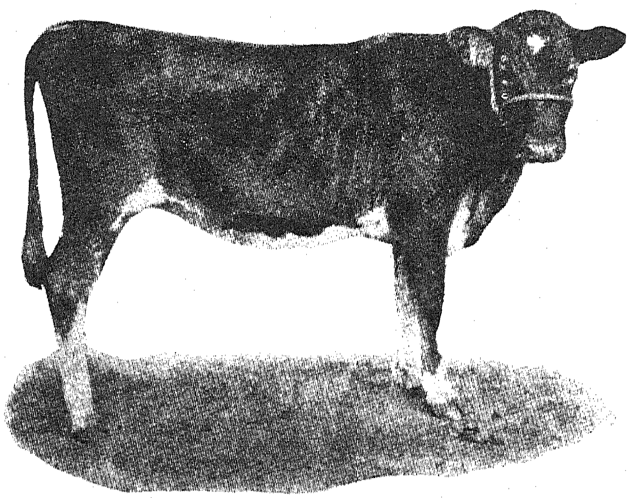
The oft-neglected age (six to 15 months).

no milk other than skim milk. The addition of calf food, such as Meggitt's Meal or specially prepared calf foods in quantities as prescribed by the makers, is recommended to make up the deficiency of fat in skim milk. A very suitable mixture may be made by boiling together one part linseed meal and two parts pollard and adding about one pint of the porridge-like mixture to the skim milk. One ounce of lime water per day is beneficial in counteracting stomach acidity, thus preventing "scours."

Feeding should be at frequent intervals especially in the case of young calves, and at least three times a day is recommended. In nature the calf obtains drinks at fairly frequent intervals, but the feeding of whole rich milk is not desirable and is often the cause of digestive troubles. A calf reared on its mother in the natural state, as with the beef breeds, receives a milk which is, as a rule, low in fat content as compared for instance with Jersey or Guernsey milk. The regularity of time of feeding, temperature of

feeding, and cleanliness in all particulars are *essential* in the rearing of the calf, and the *prevention* of the most dreaded of all calf diseases, namely, "scours." Without doubt, prevention of "scours" is the best cure. The quantity of milk fed should vary from about 10lbs. to 18lbs. per day, according to the capacity of the calf, but in no circumstances should the calf receive the utmost it can drink.

The feeds recommended to supplement and be fed with skim milk have been referred to. In addition, grains such as crushed oats, barley, with a little bran in troughs for the calves to pick up after feeding with milk, are strongly recommended. Where clover-hay, pea-hay, and lucerne-hay can be grown, it should be conserved and placed in racks to be fed to calves as they grow older. Leguminous hays are, without doubt, the best foods for young stock, and, where it can be grown, the advantage should be availed of.



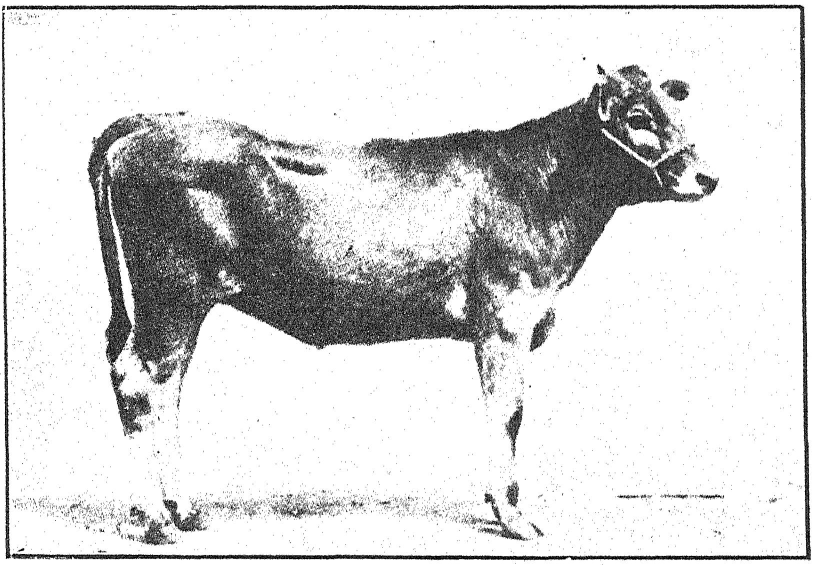
The breeding age (15 to 22 months).

A very interesting and valuable experiment conducted at Woburn in England, showing the most profitable method of feeding calves with additions of skim milk, is as follows:—

——	Food.	Gain per calf per week.
		lb.
Lot 1	Cod Liver Oil	9·66
Lot 2	Calf Meal	8·66
Lot 3	Gruel	8·33
Lot 4	Whole Milk	12·83
Lot 5	Crushed Oats	13·30

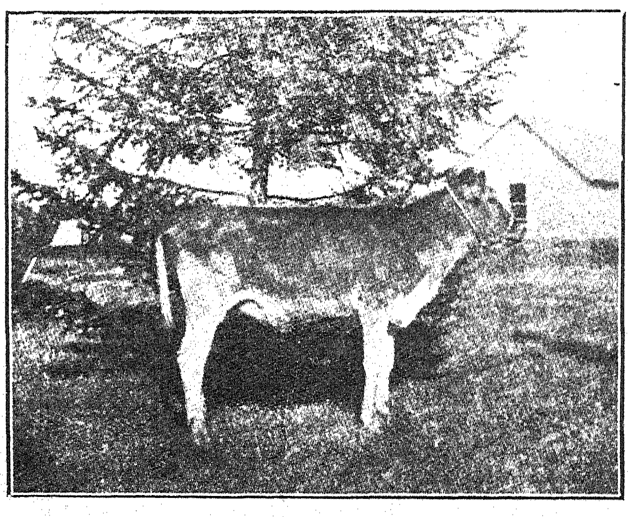
The calves, when three weeks old, were put on the various foods, and it will be seen that crushed oats gave the highest gain in live weight. The next highest gain was with whole milk, but the cost of the gain was altogether too expensive. The oats were not ground finely but were merely bruised as is ordinarily done on our farms for feeding horses.

Another series of experiments conducted by Woll and Voorhies in California (Bulletin No. 271) concludes that "vigorous thrifty calves of satisfactory body weights can be readily raised on separated milk, grain feeds, and hay."



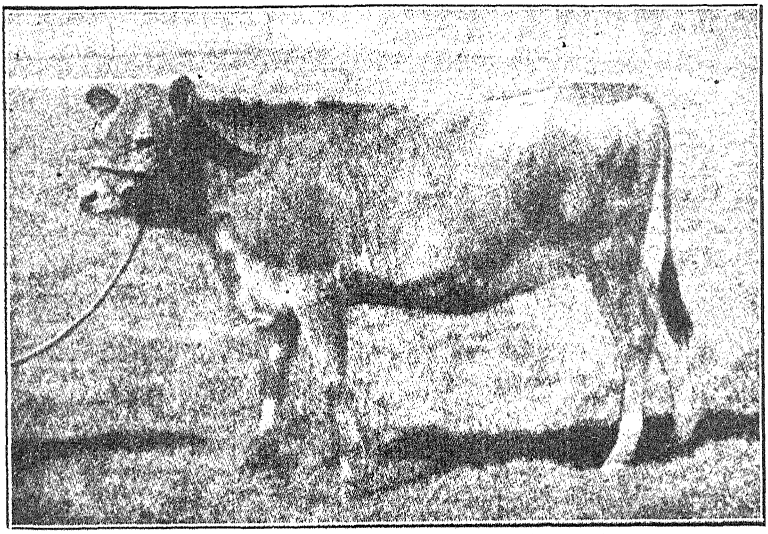
This heifer is in good growing condition (aged one year).

Crushed grain, such as oats or barley and bran, should be fed always in troughs, following the feeding of skim milk. Such feeding subsequent to a drink of milk also has the advantage of eliminating the desire of suck, so



This heifer is too low in condition.

prevalent among calves. Cereals contain a large amount of carbo-hydrates or starch which must be masticated and mixed with saliva to be properly digested. If fed with milk, the grain is bolted into the stomach and the majority passes through undigested.



This heifer carries too much condition.

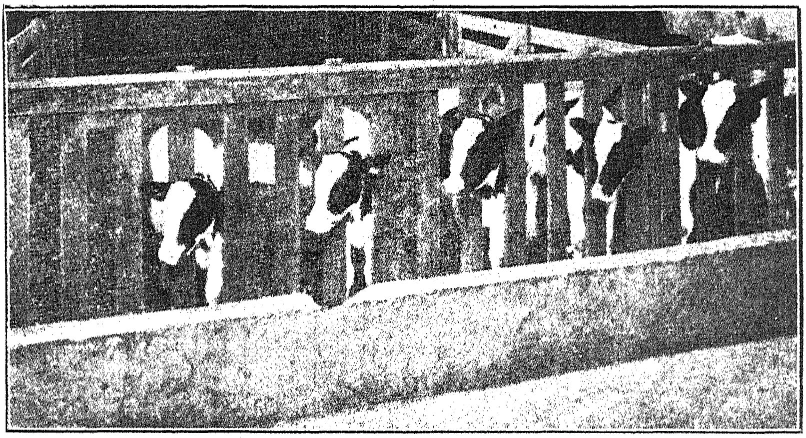
Calf-feeding bails are a distinct advantage where large numbers of calves are fed, as they permit of definite quantities to be fed to each calf

Calves reared under good conditions.

with no likelihood of the milk being knocked over, and, if the calves are penned up for, say, twenty minutes after the feeding of milk and then are given grain, the tendency to suck one another will go off. Where only a few young calves are being fed it is of advantage to tie them up, but in all cases provision should be made for proper shade in the summer and shelter in the winter.

Tied calves should be moved frequently to clean pastures to avoid the ground becoming foul, which otherwise would obtain if constantly tied in one place. Access to pastures, if possible, at all times is highly desirable.

Calves and young stock should not run with full-grown stock. Where large numbers of calves are reared it is of distinct advantage to grade according to size and age into separate paddocks, and all changes of feed should be gradual.



Calf-feeding bails.

Silage is of great value in feeding calves after they have reached the age of three months. A small quantity should be fed at first and gradually increased. It is of particular advantage in districts where pasture is not available.

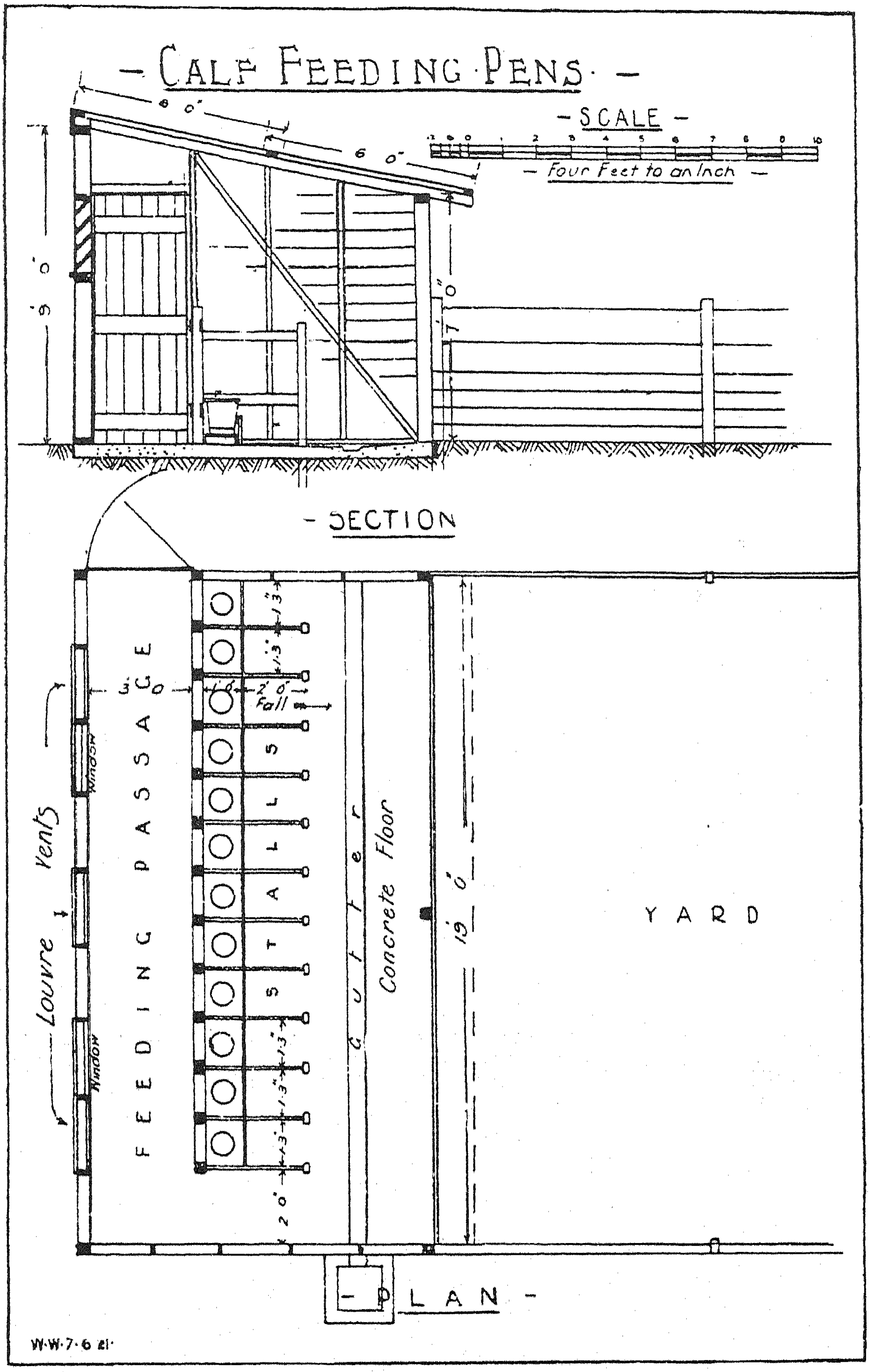
Dairy heifers are expected to gain at least 1lb. per day up to three months, and average slightly more than 1lb. per day gain from birth to one year. It is inadvisable to allow young heifers to get over-fat, as, apart from the fact that it tends to beefiness and lack of milk production, there is also the danger that they will be non-breeders.

CONCLUSIONS.

All dairy heifers are of great potential value to Western Australia:—

- Well-reared heifers grow to full size.
- Well-reared heifers reach maturity at a comparatively early age.
- Well-reared heifers possess capacity for feed, vigour, and constitution.
- Well-reared heifers are likely to be profitable producers of calves and milk.
- Well-reared heifers command highest prices from buyers.

Feeding and care represent 75 per cent. of the heifer's worth.


- CALF FEEDING PENS -
- SCALE -
- Four Feet to an Inch -
- SECTION
FEEDING PASSAGE
STALLS
Gutter
Concrete Floor
YARD
Louvre Vents
Window
Window
Fall
- PLAN -
W.W. 7.6.21.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION TESTING SCHEME.

Conducted by Dairy Branch, Department of Agriculture, Western Australia—Results for the Year ended 30th June, 1925.

Name of Cow.	Owner.	Breed.	* Herd Book No.	Age. yrs.	Age. mth.	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.
MATURE COWS—STANDARD REQUIRED, 350LBS. BUTTER FAT—273 DAYS.											
				yrs.	mth.			lbs.	%	lbs.	lbs.
Maranora of Tellaraga	R. H. Rose	Jersey	6707	7	2	16–5–24	273	11,509	5·04	580·48	26½
Yarraview Bonnie Annie	A. W. Padbury ...	Guernsey	574	6	11	23–6–24	273	8,656	6·39	553·53	25½
Fairy of Dardanup	R. H. Rose	Jersey	8492	6	4	20–5–24	273	11,235	4·80	539·41	30
Girlie of Sarnia	D. Malcolm	do.	9992	5	9	21–8–24	273	10,039	5·11	513·12	26½
Campanilles Maid of Garden Hill ...	R. H. Rose	do.	8935	10	5	11–11–23	273	9,235	5·53	511·18	30½
Fancy of Liryclea	A. H. Henning ...	do.	6674	6	10	24–7–24	273	9,114	4·83	437·40	23
Lady Fowler 4th of Dardanup	D. J. Goyder	do. ...	10004	7	2	20–11–23	273	7,846	5·42	425·72	23
Silver Bell of Roelands	A. H. Henning ...	do.	10047	6	5	20–7–24	273	8,397	4·82	405·14	19
Wild Rose, II. of Garden Hill	W. Padbury	do.	10091	7	2	7–10–23	273	6,534	5·77	377·03	9½
Noreen V. of Banyule	do.	do.	7125	5	5	7–10–23	273	5,713	6·07	346·96	14
Ettie IV.	do.	do.	2889	13	1	4–10–23	273	7,683	4·44	341·43	15
Lady Betty II. of Koogan	A. W. Padbury ...	Guernsey	872	6	7	23–6–24	273	7,728	4·27	330·07	16
Cheerful II. of Yarralla	A. H. Henning ...	Jersey	6258	7	8	17–10–23	273	5,799	5·57	323·29	17
Mokine Picotee	Walker & Co.	do.	8486	7	2	22–7–24	273	5,436	5·90	321·02	12
Creamy of Calcamine	G. C. Spencer	do.	10631	5	2	16–8–24	273	5,113	6·03	308·33	9½
Gladness of Woollongbar	Department of Agriculture	Guernsey	452	5	5	25–9–23	273	5,967	4·88	291·45	16
Duchess of Calcamine	G. C. Spencer	Jersey	10093	5	9	13–5–24	240	4,065	6·00	244·14	6½
Milkmaid 1st of Blackheath	H. O. Simms	M.S.	10091	5	10	15–5–24	240	5,505	3·73	205·32	18
Lady Fowler 5th of Dardanup * ...	D. J. Goyder	Jersey	9990	6	8	26–5–24	90	2,550	4·79	122·37	27
SENIOR 4 YEARS OLD (OVER 4½ YEARS AND UNDER 4½ YEARS)—STANDARD REQUIRED 325LBS. BUTTER FAT.											
Mokine Fancy	T. H. Wilding	Jersey	8484	4	7	11–8–24	273	8,641	5·83	504·47	10½
Bolebek Judith	A. L. B. Lefroy ...	Fresian	291	4	9	23–5–24	273	14,164	3·16	448·72	36½
Milton's Syringa	A. W. Padbury ...	Guernsey	503	4	7	4–12–23	273	6,465	6·22	402·07	16
Mokine Woodbine	T. H. Wilding	Jersey	8487	4	11	5–9–24	273	6,901	5·63	388·84	15½
Lady Fowler 7th of Dardanup	T. L. Rose	do.	10006	4	11	1–11–23	273	7,188	5·11	367·73	20
Bolebek Dorothea	A. L. B. Lefroy ...	Fresian	293	4	9	14–4–24	273	7,306	3·78	276·88	15½
Retford Tessie	W. Padbury	Jersey	8464	4	7	10–10–23	183	2,952	5·53	163·28	9
Yarraview Georgina †	A. W. Padbury ...	Guernsey	782	4	8	18–6–24	30	825	5·12	42·27	27½

JUNIOR 4 YEAR OLD (OVER 4 YEARS AND UNDER 4½ YEARS)—STANDARD REQUIRED, 300LBS. BUTTER FAT.

Lady Fobes Veeman	A. L. B. Lefroy ...	Fresian	620852 U.S.A.	4	5	11–4–24	273	16,533	3·17	524·88	46
Daisy Vale of Grass Vale	R. H. Rose	Jersey	8474	4	2	4–2–24	273	8,143	5·71	465·45	30½
Bolebek Joy	A. L. B. Lefroy ...	Fresian	1117	4	4	24–9–24	210	9,840	3·79	343·26	28½
Mokine Malmaison	Walker & Co.	Jersey	11724	4	2	7–10–24	273	5,821	6·16	358·93	10½
Lady Fowler 10th of Dardanup ...	R. H. Rose	do.	10009	4	2	25–12–23	273	6,297	5·12	322·62	14½
Bolebek Frieda	A. L. B. Lefroy ...	Fresian	1116	4	1	17–2–24	273	8,664	3·50	303·79	23
Rocket of Wollongbar	Department of Agriculture	Guernsey	541	4	5	14–10–23	273	6,018	4·85	291·89	12
Gentle of Blackheath	D. Malcolm	M.S.	11679	4	2	19–11–23	273	5,269	4·15	220·25	5
Vanity VII. of Oakdale	H. O. Timms	do.	...	4	2	5–3–24	240	3,750	4·20	157·71	9

SENIOR 3 YEAR OLD (OVER 3½ YEARS AND UNDER 4 YEARS)—STANDARD REQUIRED, 275LBS. BUTTER FAT.

Jean II. of Grass Vale	R. H. Rose	Jersey	9996	3	10	5–6–24	273	8,248	6·01	495·72	19½
May of Blackheath	Wooroloo Sanatorium ...	M.S.	N.Y.A.	3	9	31–8–24	273	12,156	3·99	485·14	22
Treasure III. of Homeleigh	D. Malcolm	I.M.S.	4648	3	9	21–10–23	273	8,829	4·68	413·77	22½
Mokine Empire Lily V.	T. H. Wilding	Jersey	10635	3	9	20–5–24	273	5,197	6·99	363·41	12½
Virginia of Nundorah	A. W. Padbury ...	Guernsey	778	3	10	5–8–24	273	5,713	5·45	312·37	14½
Bolebek Dulcena	A. L. B. Lefroy ...	Fresian	1120	3	9	26–4–24	273	8,475	3·62	307·16	25
Mermaid of Blackheath	D. Malcolm	M.S.	12156	3	11	1–12–23	273	4,745	4·09	194·20	13

JUNIOR 3 YEARS OLD (OVER 3 YEARS AND UNDER 3½ YEARS)—STANDARD REQUIRED, 250LBS. BUTTER FAT.

Picton's Trequean Flirt	A. W. Padbury ...	Guernsey	747	3	3	18–6–24	273	9,093	4·94	449·81	31
Lily of Grass Vale	R. H. Rose	Jersey	8947	3	4	6–1–24	273	8,772	5·03	442·87	32
Lady Fowler 13th of Dardanup ...	D. Malcolm	do.	8986	3	5	13–7–24	273	7,981	5·53	441·27	20½
Lady Fowler 12th of Dardanup ...	R. H. Rose	do.	10011	3	3	6–2–24	273	8,065	4·81	388·15	24
Daisy 2nd of Garden Hill	Walker & Co.	do.	10629	3	5	2–9–24	273	6,759	5·20	352·06	23
Lady Fowler 17th of Dardanup ...	R. H. Rose	do.	11695	3	1	17–9–24	273	5,844	5·79	338·59	18
Madge II. of Dalebank	D. Malcolm	do.	8449	3	3	1–12–23	273	5,180	6·36	329·80	18
Bolebek Roma	A. L. B. Lefroy ...	Fresian	1124	3	4	7–4–24	273	8,286	3·75	310·91	22
Velvet of Wollongbar	Department of Agriculture	Guernsey	774	3	5	19–10–23	273	5,703	4·45	242·79	8
Primrose of Calcamine	G. C. Spencer	Jersey	10062	3	2	14–8–24	273	4,117	5·83	240·18	7½
Handsome Girl of Calcamine	do.	do.	10061	3	2	5–5–24	240	3,165	6·55	207·51	5½
Honey of Blackheath	H. O. Timms	M.S.	11766	3	5	15–4–24	273	5,307	3·57	189·68	14
Thelma of Blackheath	do.	do.	12847	3	5	13–3–24	240	3,600	4·10	147·90	10½
Lady Betty of Koogan †	A. W. Padbury ...	Guernsey	655	3	2	11–6–24	30	780	4·33	33·78	26

SENIOR HEIFERS (UNDER 3 YEARS AND OVER 2½ YEARS).—STANDARD REQUIRED 225LBS. BUTTER FAT.

Milton's Dulcie II.	A. W. Padbury ...	Guernsey	928	2	8	14–4–24	273	8,571	5·06	433·93	27
Lady Fowler 11th of Dardanup ...	T. L. Rose	Jersey	10010	2	11	14–12–23	273	6,996	5·76	403·42	19
Milton's Daisy II.	A. W. Padbury ...	Guernsey	922	2	11	18–6–24	273	6,976	5·39	376·19	15½

* Withdrawn. † Sold.

HERD TESTING—continued.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age. (yrs.)	Age. (mth.)	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.
SENIOR HEIFERS (UNDER 3 YEARS AND OVER 2½ YEARS—STANDARD REQUIRED 225LBS. BUTTER FAT.—*continued.*											
				yrs.	mth.			lbs.	%	lbs.	lbs.
Dinah II. of Wollongbar	Department of Agriculture	Guernsey	832	2	8	2–10–24	273	7,089	51·9	367·95	23
Dunalister Manakin Perees Capture II. ...	R. H. Rose	Jersey	10392	2	9	13–6–24	273	5,652	6·05	342·20	9
Sheila of Sarnia	D. Malcolm	do.	8452	2	11	16–10–23	273	5,392	6·21	334·99	14
Colleen of Rosewood	A. W. Padbury ...	Guernsey	819	2	7	14–8–24	273	5,673	5·61	318·40	16
Mokine Noble Lily...	Walker & Co.	Jersey	11795	2	9	12–8–24	273	6,367	4·85	308·74	17½
Netherland Johanna of Lydholme ...	A. L. B. Lefroy ...	Friesian	1355	2	11	1–10–24	210	8,055	3·65	295·35	27½
Netherland Colanthe Princess of Lydholme	A. L. B. Lefroy ...	Friesian	932	2	10	6–7–24	273	7,200	3·69	266·28	10
Gladness II. of Wollongbar	Department of Agriculture	Guernsey	631	2	7	27–11–23	273	4,299	5·77	248·39	12
Blossom of Calcamine	G. C. Spencer	Jersey	10058	2	11	15–5–24	273	4,465	5·44	243·19	8½
Junket of Koogan †	A. W. Padbury ...	Guernsey	654	2	9	2–3–24	150	3,148	4·91	154·78	17
Beauty of Sarnia	D. Malcolm	Jersey	12086	2	9	3–5–24	273	2,325	5·61	130·55	5
JUNIOR HEIFERS (UNDER 2½ YEARS).—STANDARD REQUIRED, 200LBS. BUTTER FAT.											
Mokine Empire Lily VII.	T. H. Wilding	Jersey	11794	2	5	14–2–24	273	6,755	5·84	388·31	23
Golden Pearl 4th of Wollongbar ...	Department of Agriculture	Guernsey	863	2	4	8–6–24	273	6,882	5·60	385·79	19
May Queen of Sarnia	A. H. Henning ...	Jersey	12089	2	4	15–9–24	273	5,734	6·21	356·35	16½
Madge of Sarnia	D. Malcolm	do.	13437	1	9	15–5–24	273	5,863	5·74	336·97	19½
Mokine Clove Carnation	Walker & Co.	do.	11796	2	4	2–4–24	273	4,779	6·70	320·52	13
Lily's Gem of Grass Vale	R. H. Rose	do.	15698	1	8	27–9–24	273	5,758	5·10	293·43	14½
Jessica of Grass Vale	do.	do.	...	2	0	10–9–24	273	6,027	4·75	286·39	14
Lilly Rye of Grass Vale	do.	do.	...	2	0	5–10–24	273	5,208	5·47	285·17	16
Noraleda II. of Roelands	do.	do.	14337	2	5	22–8–24	273	4,996	5·61	280·55	10½
Rye Cream of Grass Vale	do.	do.	...	1	11	27–9–24	273	4,843	5·73	277·78	14½
Makanora of Grass Vale	do.	do.	12257	2	3	19–9–24	273	5,373	5·10	273·06	16
Nymphea of Juadine	Walker & Co.	do.	12081	2	2	11–7–24	273	4,444	5·87	261·15	11½
Lady Rye of Grass Vale ‡	R. H. Rose	do.	...	1	8	1–10–24	240	5,025	4·93	248·01	12½
Lonesome of Calcamine	G. C. Spencer	do.	13439	2	0	6–7–24	273	3,808	5·82	221·86	4½
Queen of Sarnia	D. Malcolm	do	12091	2	4	15–12–23	273	4,173	4·92	205·37	13

Carnation 3rd of Greyleigh	do.	I.M.S.	...	2	0	18–1–24	273	5,600	3·49	195·51	12
Myrtle 12th of Greyleigh	do.	do.	...	2	3	26–4–24	273	4,557	4·04	184·49	4
Mariposa of Yarralla *	A. H. Henning ...	do.	...	2	1	4–11–24	210	3,060	5·35	163·71	4
Girlie III. of Sarnia	D. Malcolm	do.	12087	2	3	24–7–24	210	1,950	6·13	119·58	5
Peeress of Jaudine *	Walker & Co.	Jersey	13440	1	9	22–8–24	90	1,215	6·37	77·49	11
Bonnie Margaret of Koogan *	A. W. Padbury ...	Guernsey	808	2	0	16–5–24	30	480	6·23	29·04	16
Lady Fobes Veeman	A. L. B. Lefroy ...	Friesian	620852 U.S.A.	4	5	11–4–24	365	20,130	3·28	660·24	39
Girlie of Sarnia	D. Malcolm	Jersey	9992	5	8	21–8–24	365	12,750	5·17	660·00	27
Fancy of Liryclea	A. H. Henning ...	do.	6674	6	10	24–7–24	365	11,210	4·91	550·57	25
Lady Fowler 14th of Dardanup ...	R. H. Rose	do.	12093	1	11	30–8–23	365	9,365	5·57	521·86	20½
Morden Lady of Koogan	A. W. Padbury ...	Guernsey	722	3	1	23–9–23	365	13,181	3·81	502·59	31
Golden Pearl 4th of Wollongbar	Department of Agriculture	do.	863	2	4	8–6–24	365	8,665	5·80	502·48	20
Annetta III. of Wollongbar	do.	do.	589	2	8	2–9–23	365	6,589	6·07	400·37	18
Gladness of Wollongbar	do.	do.	452	5	5	25–9–23	365	7,470	5·05	377·31	16
Rocket of Wollongbar	do.	do.	541	4	5	14–10–23	365	7,244	4·91	355·09	14

* Withdrawn. † Sold. ‡ Died.

THE APPLICATION OF THE LABORATORY TO THE PROBLEMS OF STOCK DISEASES.

H. W. BENNETTS,
Veterinary Pathologist.

A Veterinary Pathological Laboratory has recently been commenced in connection with the Agricultural Department of this State.

It does not seem out of place, at this early stage of its development, to briefly state the uses and methods of such a branch, and more particularly to put before the section of the public most likely to benefit by its existence the most satisfactory methods of furnishing material for laboratory examination.

With regard to its essential uses, such a laboratory is primarily for the diagnosis, or definite confirmation, of the diagnosis, of known stock diseases, and for research into the cause, prevention and treatment of unknown stock diseases. Research methods may also be applied to various phases of known stock diseases where our knowledge is as yet incomplete.

A laboratory may be used for more specialised purposes, for example, the preparation, on a more or less large scale, of biological products—vaccines, serums, toxins, etc.

It is very often impossible to definitely determine the nature of a disease process without the application of laboratory methods, and even then information of any value can only be obtained when the right materials are submitted for examination. Pathological and other specimens of interest forwarded to the laboratory will always be appreciated and a diagnosis will be supplied where possible.

1. *Disease Specimens—How and what to send.*—In the case of outbreaks of disease in stock, where possible, veterinary advice should be obtained or information supplied to the Stock Branch regarding the history of the affection so that stock owners may be advised specifically what to look for, and what specimens to collect for subsequent laboratory examination. However, it were well to note, especially when the diagnosis of specimens from a single animal may be required, particulars which may be of some guidance in this regard. In all cases full information should be furnished with the specimens:—

(a) Live subjects.—In the case of outbreaks of stock disease if it be possible to despatch a sick animal to the laboratory the greatest possibilities are given for a dignosis. This method is especially applicable when the distance from Perth is not very great, or if the period of sickness is likely to be sufficiently long to allow of the patient reaching the laboratory before death, or soon after death occurs. It is of course inapplicable when there is any chance of the contagion being spread to other animals during transit.

(b) Whole carcass.—The sending of the whole carcass is of value when it can be made to reach the laboratory a few hours after death, though in some bacterial diseases, where putrefaction is rapid, *post mortem* changes may mask the cause.

(c) Parts of the carcass.—Very often neither (a) nor (b) are practicable, and are even unnecessary. A definite diagnosis may often be made from specimens collected by the owner following the directions given hereunder:—

A *post mortem* examination should be made as soon after death as possible. Specimens collected immediately after death are of most value.

Any abnormal organs or parts of organs should be sent in preservative to the laboratory for examination, accompanied by particulars as to their appearance, size, colour, consistence, etc., when fresh.

Large specimens should be immediately put into five per cent. formalin solution (that is formalin five parts, water 95 parts) and despatched in a water tight container. If it is desired to send the entire intestines, etc., they may be packed in a kerosene tin with a piece of absorbent material soaked in formalin.

Usually a small portion of one of the diseased tissues, for microscopic examination only, is sufficient. For this purpose slices about quarter of an inch thick should be placed immediately in a 10 per cent. formalin solution (*i.e.*, double the strength mentioned above) in a wide-mouth bottle, corked, packed and posted to the laboratory. If possible slices should be cut so as to include a piece of the normal as well as the abnormal tissue.

(c) Smears.—In addition to preserved specimens of diseased tissues smears of pus (if present), and blood smears, often provide useful information. As a general rule blood smears alone do not provide sufficient evidence for a definite diagnosis to be made. Smears should be made by spreading a very little of the material (a very small drop of blood) as thinly as possible on a clean microscopic slide, or a piece of clean window glass, by means of another glass slide or a cigarette paper. Smears should be dried in air (being protected from flies) and packed carefully, and so that they do not stick together.

(d) Fluids, etc., for bacteriological examination.—These are to be collected in pasteur pipettes, which may be supplied, with directions as to their use, in special instances.

(e) Blood samples.—Some diseases, notably contagious abortion in cattle may be recognised by the presence of various agents in the blood serum of the live carriers of the infection. In the event of blood required for these seriological tests, samples are collected as follows:—Sufficient blood may be obtained from most animals either by nicking with a sharp knife one of the larger blood vessels in the ear, or by making a short incision along the length of the under surface of the tail (in the pig the end of the tail is cut off) the blood being made to drip into clean glass bottles (1oz.). Bottles should not be more than two-thirds full. They should be then corked, labelled and despatched as soon as possible.

2. *Laboratory Diagnostic Methods.*—Having given some idea how specimens are collected for pathological and bateriological examination, it will probably be of interest to give a brief outline of the processes whereby one arrives at a diagnosis, viz., routine laboratory methods. These ordinary routine methods may be applied to research problems, as well as to diagnostic work, though often more special work is needed.

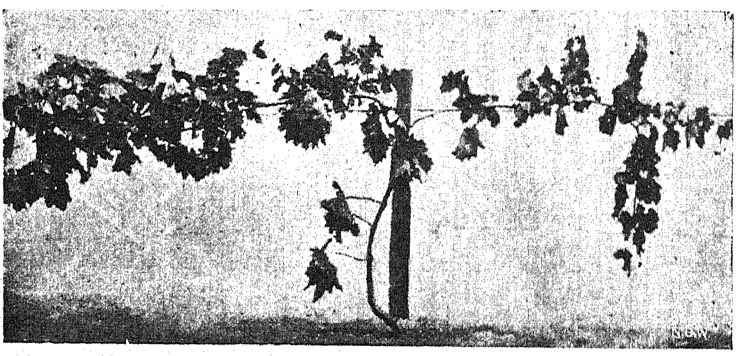
(a) Macroscopic examination, *i.e.*, naked eye appearance.—The nature and distribution of lesions (*i.e.*, alteration in structure and function of various parts of the body) may sometimes be sufficient to determine the disease. Usually, however, microscopic examination has to be resorted to, at least to confirm the diagnosis.

(b) Microscopic examination.—The smears previously referred to may be stained with various dyes and examined forthwith, but pieces of organs, etc., have to be specially prepared for cutting into very fine sections. They are then fixed on to glass slides, stained and examined microscopically, one being able thereby to see what alterations in structure have occurred; and often, also, to arrive at the cause of the same. It may, however, be necessary to go still further, and in bacterial diseases adopt cultural methods, viz., to grow the organisms.

(c) Cultural methods.—Material is collected in a sterile fashion and various culture media are inoculated with some particles of the organisms contained in the diseased tissues, and are grown in tubes. Many different nature material are used (broth, milk, serum, potato, etc.), and often the cultures obtained on these are so characteristic (macroscopically and microscopically) that nothing further is needed.

(d) Animal inoculation.—It is, however, often necessary to proceed to animal inoculation in order to test the pathogenicity (*i.e.*, disease producing power) of the bacteria. It may be in small laboratory animals (guinea pigs and rabbits) or possibly in healthy animals of the same species as that from which the infection was recovered.

(e) Bacteriological tests.—The blood serum from animals with certain diseases may act characteristically upon the bacteria previously recovered from an infected animal and grown in the laboratory in a tube. Thus it is possible to determine, in the laboratory, the existence of certain diseases by means of blood samples taken from animals carrying the infection.



BREEDING LAMBS FOR MARKET.

Fat lamb production is usually a profitable occupation, either in the permanent flock or when sheep are obtained for the purpose of breeding a lamb and then being disposed of. There are two essential factors—

(a) The farm must be within easy distance of the railway, and

(b) A supply of feed must be assured so that the lambs grow quickly.

In Western Australia this branch of the sheep-raising industry has a great advantage, in that it can be undertaken at a moderate outlay of capital. Although the local demand is comparatively small, a lucrative export trade could be built up. For the purpose of raising a lamb or two, old ewes are better than young ones, indeed they are to be preferred: they are very much quieter and they can be purchased for much less money than young animals. There are, however, old ewes and *old ewes*. The buyer, therefore, must be careful to avoid sheep which, though not very old, may be undesirable. Amongst the old ewes there is a much better choice than amongst the young ones. Cast for age ewes from a good flock can be obtained, but an owner cannot be tempted to sell desirable young ones. Old Merino ewes appreciate a quiet life much better than the younger sheep; with kind treatment, quietness, and ample feed they improve wonderfully. It is wise, however, not to keep them for more than one or two seasons.

In selecting the ewes all that is required is to see that they are large-framed, and of good sound constitution.

The choice of the rams requires the exercise of care and judgment. For lamb breeding no rams are as suitable as those of the Downs breeds, and of these the Dorset Horn, Shropshire, and South Down are the best. Border Leicester, Lincoln, and Romney Marsh, however, are all serviceable sheep for this purpose.

A coming producer of fat lambs is the Corriedale. The reputation this breed has made abroad has excited the envy of sheepmen.

The Romney Marsh sheep are very useful for raising lambs in cold exposed situations, as their progeny are very hardy, grow well, and fatten rapidly. There is this objection, however, to crossing with merino ewes—the lambs' heads are so large that many of the ewes die in lambing. This trouble is not experienced if cross-bred ewes are used. The Border Leicesters will prove serviceable almost anywhere.

In selecting the sires, size, shape, and a tendency to early maturity are much more important points than the quality or even the quantity of their wool.

Rams of any of the breeds named as suitable to mate with Merino ewes will answer quite as well when mated with cross-bred ewes.

It is better to pay a good price when procuring a ram for this purpose, and get one from a high-class stud that has an established reputation for soundness of constitution and early maturity: an extra pound or two laid out in the purchase of a pure-bred sire is money well spent, even to breed cross-bred lambs. The farmer should of all things avoid an undesirable

ram: he, having no type with which to stamp his progeny, cannot be depended upon and will prove in the future, as he has done in the past, a disappointment to the owner.

When purchasing a draft of ewes for the purpose of raising lambs for market, large-framed merinos will be found to be cheaper, and, in most districts more suitable, than cross-bred ewes. Pure-bred long-wool ewes are too dear to be available.

In breeding lambs for the market, strength of constitution is just as much required in the stock as in breeding a permanent flock. A sturdy, well-shaped lamb will thrive from the first, whilst a weakly one will be a useless encumbrance upon which good food will be thrown away. It is of the greatest importance that the lamb should continue to thrive from the date of birth until time of sale to the butcher.

For lamb breeding, merino ewes are more useful than long wools or crossbreds, as they take the ram more readily and can thus be used for producing lambs at any required season.

SHEEP PASTURED IN WESTERN AUSTRALIA.

HUGH McCALLUM,
Sheep and Wool Inspector.

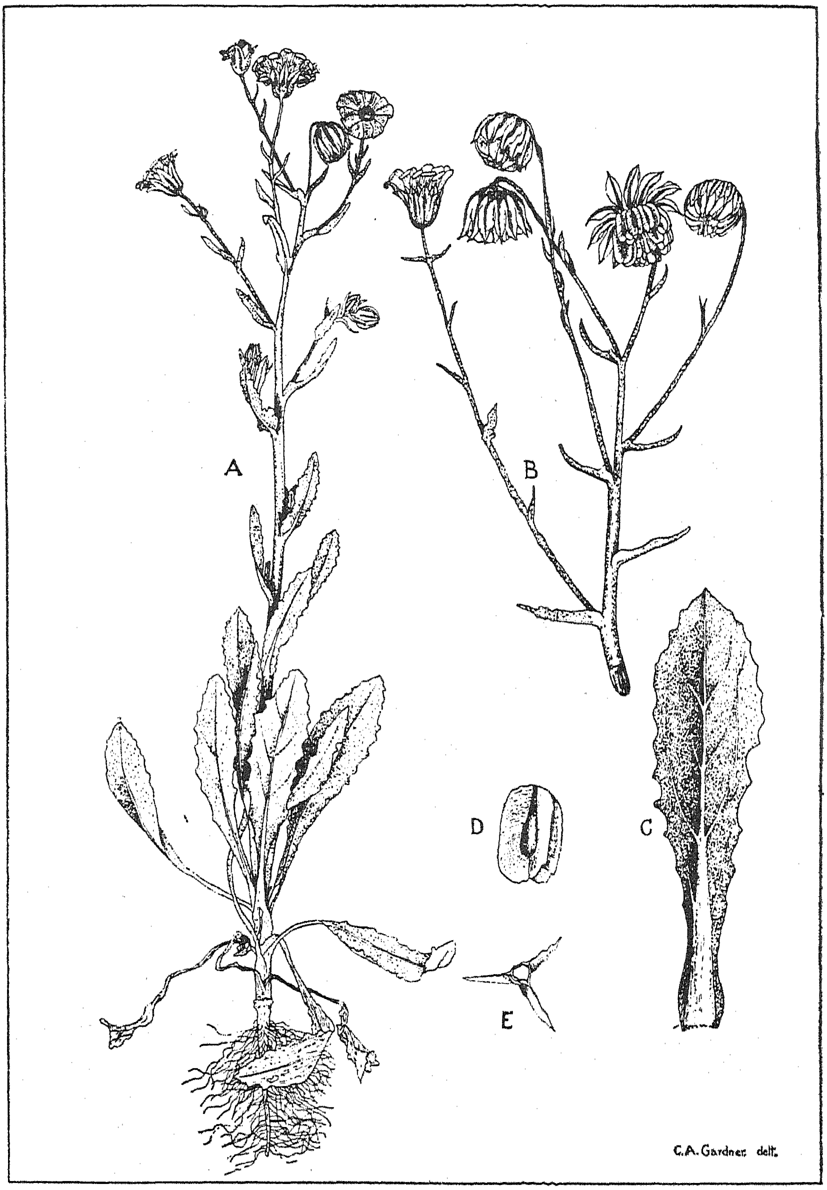
Considering the enormous tract of undeveloped country we have in this State suitable for pastoral pursuits, there is no part of the Commonwealth that should be brought more prominently before the outside world in regard to possibilities for settlement.

The following figures, taken from a return issued by the Government Statistician, Mr. S. Bennett, show the number of sheep pastured in the State as at the 31st December, 1923 and 1924:—

Victoria	1,114,677
Swan	57,025
Wellington	63,950
Sussex	62,161
Northam	387,476
York	263,805
Beverley	182,410
Pingelly	112,725
Wickepin	81,796
Narrogin	174,928
Lake Grace	50,228
Wagin	196,252
Dumbleyung	91,188
Katanning	308,018
Tambellup	289,869
Plantagenet	81,456
East Kimberley	965
West Kimberley	123,742
North-West	1,167,946
Gascoyne	889,970
Murchison	277,436
East Murchison	27,526
Magnet	285,590
Margaret	13,116
North Coolgardie	38,877
Yilgarn	—
Coolgardie	2,676
Eucla	3,000
Esperance	26,809
Phillips River	20,973
Totals for 1924	6,396,590
Totals for 1923	6,595,467

Western Australia has a carrying capacity for more than double this number, and with improved flocks and methods the revenue of the State from this source would be materially increased.

It will be seen that the figures show a decrease of approximately 200,000 sheep for 1924 as against 1923. This was mainly due to the necessity to reduce the flocks pastured in the North-West owing to the continued bad season, and it is hoped that the re-stocking during 1925 will show a large increase on the 1923 numbers.



STINKING ROGER.

(*Tripteris clandestina*, Less.)

A. Young plant. B. Fruiting heads. C. Leaf.
D. Fruit ("seed"). E. Fruit in transverse section.

STINKING ROGER.

(*Tripteris clandestina, Less.*)

W. M. CARNE, F.L.S., and C. A. GARDNER.

This common weed is an annual herb well established in Western Australia. Its original home in South Africa, where it is very common, particularly around Capetown. The date of its introduction into Western Australia is not known, but is prior to 1863, plants having been collected in the Swan River district by James Drummond, the first Colonial Botanist, before that date.

As far as we know this plant has not made its appearance in any of the Eastern States, being confined to the Agricultural and Eastern Goldfields districts of Western Australia.

The generic name *Tripteris* means "three-winged," and is applied to the seed-like fruits; *clandestina* refers to something concealed, probably the flowers, which are almost covered by the semi-transparent bracts of the head. The common name of "Roger" is obscure, but the fact that the plants are strongly and rather disagreeably scented accounts for the name "stinking."

Stinking Roger is now one of the commonest of our weeds. It is particularly abundant in the Wheat Belt where sometimes it invades wheat paddocks almost to the exclusion of the crop. It thrives better in the light lands than in the heavier forest soil where usually it is uncommon. Although an objectionable weed it has the redeeming feature that stock will eat it when it is young, especially when feed is scarce. If there is other more attractive feed they will avoid it. In the drier areas, therefore, the plant is much less serious than in more favoured localities, where the light lands carry much early feed.

Description of Plant.—A viscid herbaceous annual with an erect stem paniculately branched and glandular-hairy. Leaves mostly basal, the lower ones four to five inches long, oblong, blunt, slightly and obtusely toothed, sparsely hairy, much narrowed towards the base; the upper leaves much smaller, and more or less clasping the stem, one to one and a-half inches long.

Flowers daisy-like, usually drooping. The exterior is composed of several scale-like bracts sharply pointed, almost transparent, with a narrow opaque greenish-purple centre. The rays of the flower-head scarcely exceed the bracts, and are yellow with purple lines underneath, and rolled outwards and backwards at the tips. The centre of the daisy is composed of several small tubular flowers of a deep purple.

The small seed-like fruits are borne in numbers inside the bracts, and are broadly three-winged, the wings being transparent. Each is one-seeded.

Flowering period September to November.

Distribution.—Stinking Roger, like the majority of daisy-like plants, is wind distributed. The light fruits (seeds) provided with wings, float in the air for considerable distances. At the same time the plant does not produce the same number of seeds as many other species of the same family (*e.g.*,

stinkwort and thistle), and the number of seeds is much fewer in the head. Its appearance, therefore, in a district is first noticed by small isolated patches which, if not kept down, may in some soils, particularly in fallowed land, or where it has gained the ascendancy over the crop, develop into a serious trouble.

The weed is most prevalent in the Avon district, where the light lands have provided a suitable environment. In the Great Southern districts it is not so common, stinkwort occupying its place. It may be found in several sandy spots around Perth and even in the Darling Range. It appears to be almost entirely absent from the extreme South-West, but has invaded the drier areas of the Eastern Goldfields and East Midlands districts.

Control.—The weed should be prevented from seeding. Small patches may be hand-pulled, or, if of small height, and feed not plentiful, fed off with sheep. If the plants are large they should be pulled up by hand. When the areas are large cultivation will prove effective, or harrowing in fallowed land. It should be remembered that the plant only lives through one season, and to prevent seeding is of the greatest importance. If allowed to seed in one paddock, it may be expected to appear elsewhere the following year. Its first appearance may be expected in fallowed land, or the lighter sandy soils.

WILD, OR SPANISH RADISH.

(*Raphanus Raphanistrum, Linn.*)

W. M. CARNE, F.L.S., and C. A. GARDNER.

Wild Radish is a serious pest of cultivated lands on the Western coastal plain, and the wetter parts of the Wheat Belt, being especially prolific in the Victoria district, particularly the Greenough Flats, between Geraldton and Dongarra.

This weed belongs to the Cruciferae, a family which includes such useful plants as cabbage, cauliflower, rape, turnip, and radish. Although closely related it is not, as generally supposed, a degenerate form of the common radish (*R. sativus*). Wild radish is regarded as a native of Europe originally, but it is now found in almost all temperate countries.

In badly affected areas the eradication of wild radish has become almost impossible, but by careful attention it may be controlled. Where it is still not plentiful immediate action should be taken to eradicate it before it obtains too strong a hold.

Wild radish is an annual plant germinating usually in the autumn and growing through the winter and spring. It usually matures its seeds between October and December. Some plants may germinate in the spring and the seeds of these plants, providing they have rains, or moist conditions, may germinate in the summer, producing plants which mature seeds when they are only a few inches high.

Not particular as to the soil it inhabits, wild radish grows most prolifically, and is most serious in rich heavy soils in cultivated land. Its importance varies in different seasons, the greatest growth taking place in seasons with early rains; when the rains are late the growth is quite noticeably smaller.

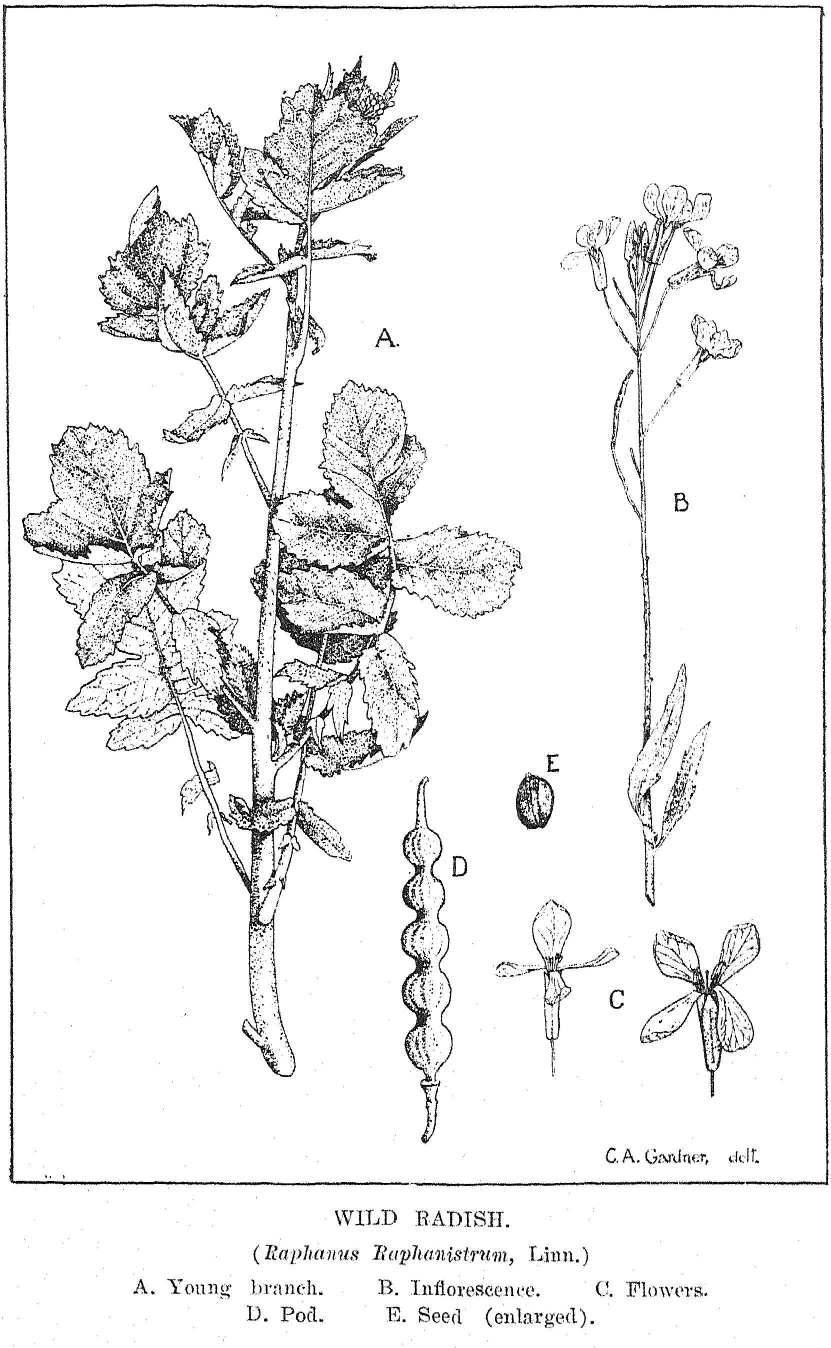
The injurious effects of wild radish are:—

(1) It chokes out crops and reduces the yield.
(2) Makes harvesting operations difficult; badly affected areas may have to be left untouched.
(3) Reduces the value of chaff and grain.
(4) Produces a large quantity of feed on land not in crop, suppressing the growth of plants such as clover and grasses which are valuable at a later season, when radish is useless.

No farmer will use chaff or grain from areas which he knows to be badly affected with wild radish, if he values the cleanliness of his crops. Grading of seed will not remove all the wild radish. Stock eating radish excrete a proportion ungerminated and sound.

Description of Plant.—An erect or spreading annual (rarely biennial) usually two to three feet in height, but under favourable conditions attaining a height of up six feet, much branched, with a few short transparent stiff hairs on the main stem. Leaves pinnately divided or lobed, the upper segments large and soft, the lower small. Upper leaves often small and entire.

Flowers about three-quarters of an inch long, white or pale yellow, with violet veins; calyx of four sepals, the outer two somewhat pouched at the base; petals four, spreading.



WILD RADISH.

(*Raphanus Raphanistrum*, Linn.)

A. Young branch. B. Inflorescence. C. Flowers.
D. Pod. E. Seed (enlarged).

Pods one to over two inches long, cylindrical, with a long terminal beak, more or less like a short string of beads, and breaking when ripe into several one-seeded pieces.

Flowers August to November.

Control.—The difficulties which attend the eradication of wild radish when it is once established are so great that many farmers are apt to abandon all attempts at control. The causes of such difficulties are:—

(1) The seed may remain in a sound condition in the soil for upwards of ten years at least.

(2) The ability of the plant to sucker or emit side shoots if cut down.

Eradication is a matter requiring time and close attention. Pulling by hand and hoeing are the most effective measures when the plants are sufficiently few to be so dealt with. In hoeing it is necessary to cut through the tap root three to four inches below the ground level, otherwise the plant will emit fresh growths. If the plants are in an advanced flowering stage they should be burnt, otherwise the seeds may mature on the dead plant.

The cultivation of fallowed land with a duck-foot or disc cultivator will keep the weed in check, provided that the plant has not already formed seeds.

Sheep, although they do not appear to relish the plant, will eat it when young. The late sowing of crops when possible is advised, so that the radish which commences to grow with the early rains may be destroyed by cultivation before sowing. Hay crops are preferable to growing for grain. Grain crops are preferable havested with stripper and winower rather than a harvester. The harvester discharges the radish seeds all over the area, while the stripper allows of the accumulation of radish seed at the winnowing dumps, and thus facilitates its destruction in definite small patches.

It must be remembered that once wild radish is established, each ploughing will bring up to the surface new seeds and produce a fresh crop of plants. This will continue until the seed in the soil is exhausted.

The converting of badly affected crops into silage is a remedy by which the weed may be turned into a profitable use. Radish seeds in the silage will be killed. The use of grazing crops of oats in affected areas will also help to keep the weed in check.

SUMMARY.

Control methods on one or more of the following lines should be adopted and maintained:—

(1) Pull, or hoe out all the small patches or occasional plants seen.
(2) Fallow, using sheep to keep the fallow clean.
(3) Grow crops of oats for grazing purposes, to be eaten off by sheep.
(4) Cultivate after radish appears in autumn, before sowing.
(5) Grow hay instead of grain on affected areas.
(6) Use a stripper in preference to a harvester, burning the deposits from the winnower.
(7) Make silage of crops badly affected with the weed.
(8) Sow clean seed.

JUDGING SHEEP AT SHOWS.

HUGH MCCALLUM,
Sheep and Wool Inspector.

In the spring of the year shows are held in many parts of the State, and at these one of the main sections is that of "Sheep." The position of judge of this section is a responsible one, requiring a person with knowledge, confidence, sound judgment, freedom from any leaning towards any particular type of animal and the courage to give reasons for the awards made.

There is no regular rule as to where to begin to examine a sheep, but the animals should be placed in good light in a row facing the judge. It is natural to commence at the most exposed part—the back. This is a part where a weakness might occur: if good on the back the sheep is worthy of further inspection. Standing at the rump the judge will usually commence at the top of the neck, gradually opening the wool down to the junction with the body. The next move is to examine the wither, always a suspicious place and one where most defects are found, and if satisfied with the shape of the sheep and its wool in this particular quarter the judge soon realises that he has something good in hand. The whole length of the back, right to the tail, is then inspected. Proceeding from the wither in a direct line to the shoulder point the next move will be to examine the girth coming behind down wide of the forearm. If this part is satisfactory it is a strong point in favour of the sheep. Next proceed to the sides, then to the near flank—or that part between the hind leg and the belly—then on down the thigh, especially on to the outer thigh or breech. All the exposed parts having been examined the animal is turned up so as to present a full view and easy access to the under parts. The folds on the chest and neck are looked into to see their form and covering; the arm, or elbow, receives searching scrutiny, also the brisket. A large well-developed covering of the belly is necessary, especially if there is a full continuous growth of wool and no thinness where the belly wool is connected with that part of the body wool. The face, eyes, mouth, horns, and ears must also be satisfactory and without blemish.

HOW TO HOLD A SHEEP FOR THE JUDGE.

Gentleness has a great effect upon sheep, and if they are handled quietly, with more persuasion than force, there would be no necessity for the dragging and bother which is frequently seen.

The steward, when handing over an animal, should impress upon the holders not to be rough, but to take it as quietly as possible and allow it to see the sheep in front. A further improvement would be for the steward to have a spare holder at hand, so that he could render assistance to anyone in difficulty. The animal should be approached quietly, and if any way fractious should be held securely by the horns with as little struggling as possible. To tussle unduly with a sheep sours its temper and it will become very obstinate, probably necessitating its being carried; this should be avoided if possible.

The sheep should be stood with its rump to the judge, the holder facing the animal and holding its head. If allowed the animal will settle itself into the most natural position, the judge can then without trouble examine it. If the head is held too high, or is pulled or pushed, the sheep becomes restless and uneasy, causing the holder to have a bad time.

Care should be exercised when the judge is examining the wool about the shoulder or wither and on top to raise the head a little, push it back gently, so as to cause the wool to appear to be dense. In this position the judge can satisfy himself as to the value or merit of the respective points, excepting the under part. The sheep should then be turned up so as to expose the belly, legs, front, and brisket. To the average holder this is the most difficult part of his task, requiring tact, together with the assistance of a little strength when necessary.

HOW TO OPEN THE WOOL WHEN EXAMINING THE SHEEP.

The main object when inspecting wool on the sheep is to open it without crushing the staples, and at the same time to expose it so as to allow a thorough inspection as to type and quality. There are many people who cannot open and inspect the wool properly. The general fault is that, instead of opening up the wool with the fingers, they dig them into the fleece, crushing the staples in all directions, so as to make it impossible for the wool to show in its most natural state. When opening up the fleece guard against pressure being brought to bear on the wool. Use the thumb and first and second fingers of both hands as spreaders; this is done by dividing the wool, not pressing, but opening out, keeping the staples straight whilst laying them down. Any stretching should be avoided, but when the wool is open it should be allowed to rest in its natural position. The wool can then be thoroughly inspected. When released after inspection the wool will close without having any crushed or pressed appearance. When examining the sides and when standing well over the sheep, the wool is required to be opened right from back to belly.

HOW TO TURN UP A SHEEP.

When a holder is required to turn up a sheep he should take his place on the near side, retaining hold of the horn with the left hand until the animal is quiet. The next move is to place the left hand well round, and under the throat, then, with the right hand, take hold of the near hind leg, lift gently in a direct line with the side of the sheep, neither pulling nor pushing it to or from him, but straight. The hind leg now being close to the side, lift the front of the sheep, and in so doing let it go gently on its near thigh or rump, where it will fall into its position between the legs of the holder. In this position the judge can examine every point with satisfaction to himself. When the sheep is not under examination the holder should slightly turn it on one side where it will rest more contentedly.

When judging sheep constitution, frame, robustness, trueness of type, evenness of covering, density, breeding, and quality have to be taken into consideration.

WOOL GROWERS' READY RECKONER.

SHOWING REDUCTIONS OF CWTS., ETC., TO LBS., FROM 1 TO $5\frac{1}{2}$ CWTS.

Wool is now weighed in lbs. instead of cwt. qrs., and lbs.

cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.	cwt.	qrs.	lbs.	lbs.
1	**0**	**0**	**112**																																
1	0	1	113	1	2	1	169	2	0	1	225	2	2	1	281	3	0	1	337	3	2	1	393	4	0	1	449	4	2	1	505	5	0	1	561
1	0	2	114	1	2	2	170	2	0	2	226	2	2	2	282	3	0	2	338	3	2	2	394	4	0	2	450	4	2	2	506	5	0	2	562
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1	1	26	166	1	3	26	222	2	1	26	278	2	3	26	334	3	1	26	390	3	3	26	446	4	1	26	502	4	3	26	558	5	1	26	614
1	1	27	167	1	3	27	223	2	1	27	279	2	3	27	335	3	1	27	391	3	3	27	447	4	1	27	503	4	3	27	559	5	1	27	615
1	**2**	**0**	**168**	**2**	**0**	**0**	**224**	**2**	**2**	**0**	**280**	**3**	**0**	**0**	**336**	**3**	**2**	**0**	**392**	**4**	**0**	**0**	**448**	**4**	**2**	**0**	**504**	**5**	**0**	**0**	**560**	**5**	**2**	**0**	**616**

SOME NOTES ON GRAIN SORGHUMS.

W. M. CARNE,
Botanist and Plant Pathologist.

Maize, that valuable summer-growing forage and grain crop, requires a considerable amount of moisture and preferably a rich soil for successful growth. These facts has to a large extent confined its use to soils which remain moist in the summer, or to those portions of the South-West which receive a reliable summer rainfall. The limited acreage cultivated is required for forage purposes, particularly for dairy cows, so that there is little commercial production of grain.

The object of these notes is to draw attention to another summer-growing grain crop, which is less exacting in its requirements, and which offers considerable possibilities as a source of grain, and also of forage for live-stock, including poultry. The crop referred to is that of the grain sorghums, particularly the varieties known as Milo Maize and Feterita and Kafir Corn. Grain Sorghums will grow successfully on poorer land and with less moisture than maize. It is not claimed that they are equal to maize where the latter thrives, but that they will do better where the conditions are less favourable. They will produce heavy crops of green forage readily eaten by stock, though it is not as palatable as maize or the sweet sorghums, such as Planter's Friend and Amber Cane. Further, if allowed to mature, they will produce crops of grain where maize fails to do so, and nearly equal to it in feeding value. Such a crop may be utilised by poultry farmers to supplement the usual grains, which owing to high prices, often seriously affect their financial returns.

While it is unsafe to predict the future of a crop new to the State, there is every justification for small trials of grain sorghum in the metropolitan, south-west and great southern districts for green forage. As a grain crop it is well worth the attention of poultry farmers.

Grain sorghums differ from sweet sorghums in being free from the sugary juices of the latter, in being more hardy, and in producing valuable grain crops. They differ from maize in being hardier, and in producing grain crops where maize fails to do so. They are usually shorter in growth. The grain is small and is borne in dense compact bunches at the top of the stalk and not on cobs. They are not readily affected by hot winds when flowering, a frequent cause of bad cobbing in maize. They are also less affected by the presence of small amounts of salt in the soil.

The grain is almost equal to maize in feeding value. It may be fed to all classes of stock, preferably after being crushed or cracked. It is fed to poultry after crushing, and is used with the morning mash in proportions up to 10 per cent.

As forage the plant can be used green, but should be allowed to wilt, if cut before flowering, by allowing it to remain in the sun for a day. This is a precaution against sorghum poisoning. There is no danger after the plants have headed. If cut when the grain is in the firm dough state, it should be tied into bundles and stooked until dry. It may be fed whole, but there is less waste if it is chaffed or shredded.

Under different names such as Kaoliang, Kafir Corn, and Dhurra grain sorghums are grown for human food in various parts of the world, but especially in Africa, both North and South, and in China.

As fodder and grain for feeding stock they are used not only in Africa and China, but also in the drier parts of the Great Plains area of the United States, in some States (as in Oklahoma) constituting one of the major crops.

Kafir Corn grown at Australind.

Little attention has been given to them in Australia, and most farmers know little or nothing of the crop. At Nyngan Experiment Farm in New South Wales, beyond the safe wheat belt line, their value has been demonstrated

for sheep feeding, and they have been successfully grown on various experiment farms in that State. Under irrigation at the Murrumbidgee Irrigation Area at Yanco, and under bore irrigation at Coonamble, they have done remarkably well. At Yanco yields of over 100 bushels of grain per acre have been obtained as against about 20 from maize.

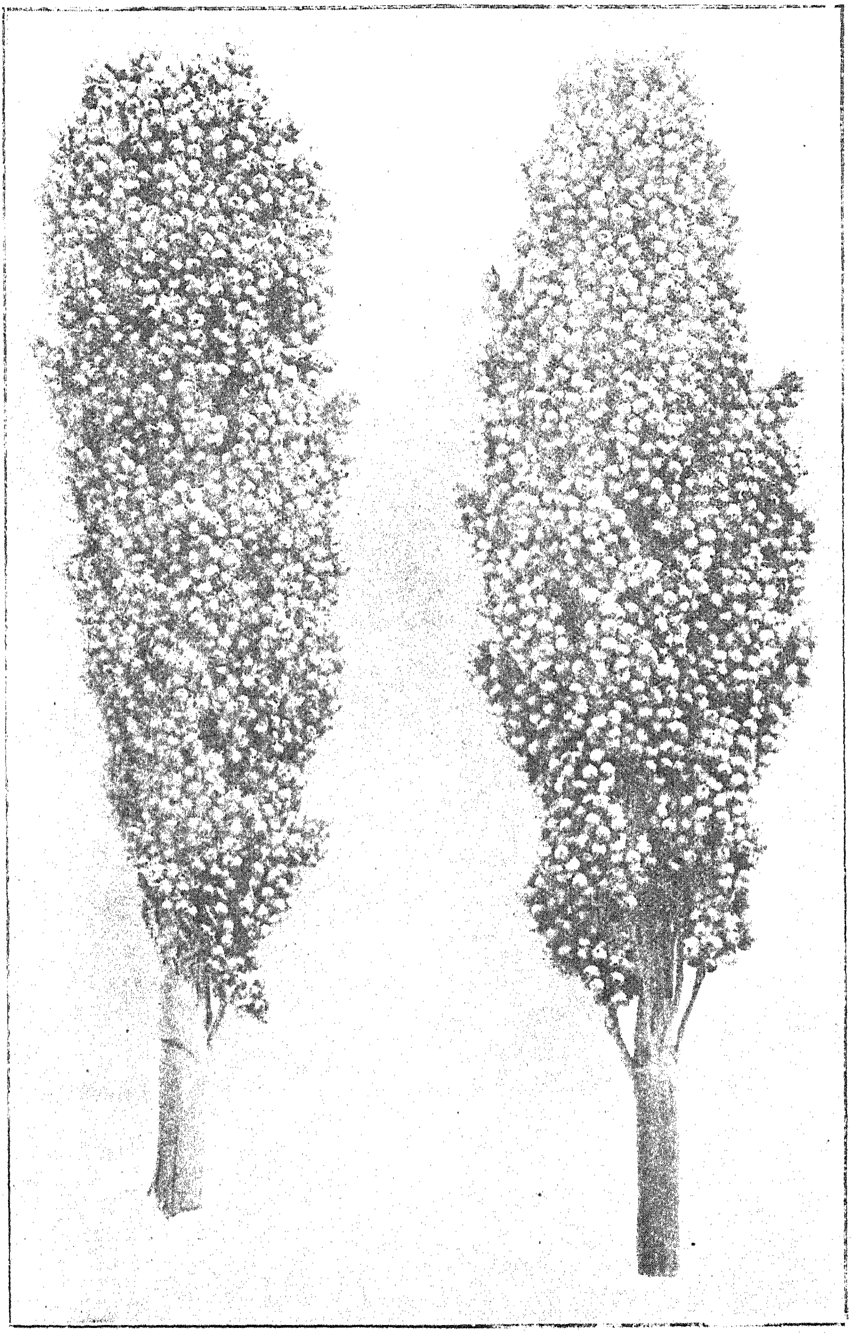
When on the Palestine coastal plain, which has a climate very similar to that of the agricultural belt of Western Australia, the writer was struck with the wonderful hardiness of a variety of Dhurra (probably Feterita), which, sown at the end of the rainy season (spring) grew to about four feet, and matured a good crop of grain without any rain during its growth.

There are many varieties of grain sorghums, but those which promise to be of the most use here are Milo, Feterita, and Kafir Corn. Kafir Corn produces the greatest bulk of forage of these three, but takes longer to mature. As a grain yielder it is less reliable than Milo or Feterita, and usually gives a lighter crop. Grain is matured in about 115 days. It grows to about six feet. Milo is the most reliable grain copper of the three. It is hardier than Kafir, and matures grain in about 105 days, growing to about five feet. It comes next to Kafir Corn in forage yield. Feterita comes away more slowly in the spring, but matures grain in about 95 days. Its grain yield is very similar to that of Milo. Height about four feet.

For green forage on soils with summer moisture Kafir Corn is worth trying in contrast with maize, where maize is only partially successful. For all round purposes, however, Milo is the most promising for trial where maize cannot be grown. Under dry conditions it will produce as much forage as Kafir Corn, and heavier crops of grain. Both Milo and Feterita may be expected to produce anything from 10 to 40 bushels of grain per acre under suitable conditions.

Cultural Notes.—Grain sorghums should be sown about the end of September or early in October. Feterita in particular requires a fairly warm soil, and may require to be sown later if the spring is mild. In the South-West late October sowings would probably be best. The seed should be sown in drills about three feet apart at the rate of 5lbs. per acre. The use of a maize dropper with a sorghum seed plate is preferable to the seed drill. Superphosphate should be used at the rate of 70 to 100 lbs. per acre. Weeds must be kept down by cultivation. For forage the crop may be cut by hand, or with reaper and binder. It should not be grazed until it has headed. If harvested for grain the stalks can then be fed as roughage. For grain the heads are usually harvested by hand, though they have been successfully harvested with a reaper-header at Cowra, New South Wales. By setting the drum as low as possible the grain is taken off well with little cracked seed. Stock may then be turned on to the stubble. The crop is sometimes cut with a reaper and binder, and stooked in the field until the grain is quite dry. The heads are then cut off with stems about one foot long, and fed into a grain thresher or harvester set up as a thresher adjusting so as to secure as little cracked grain as possible. If harvested by hand the grain may be removed from the heads with a home-made hackler, or with a flail. The grain should be thoroughly dry before storage or it may heat. If in bins it should not be more than two to three feet deep. When cut by hand the grain may be stored in the head and threshed as required. The bushel weight is about 56 to 58 lbs.

Seed for Distribution.—A limited quantity of seed of Milo is available for distribution in small parcels on application to the Department of Agriculture, Perth.



Heads of Kafir Corn.

FERTILISERS (continued).

By G. N. LOWE,
Senior Potato Inspector.

Potash.—This portion of the potato manure has, primarily due to its being unobtainable during the war period, been neglected largely, and a mixture of superphosphate and sulphate of ammonia only used.

It must be admitted that the return per acre has not suffered because of this non-inclusion of potash, although it is certainly evident that the keeping qualities of tubers grown in the older localities are not what they were and even more noticeably lacking is the culinary quality.

The probability is that the absence of potash in the fertilisers is largely responsible for this deficiency, although in our heavy soils the potash naturally available is sufficient for the requirements of the crop from the tonnage standpoint. It is hoped that the fertiliser experiments now being conducted, and in which potash is being used, may throw light on this feature of the quality of our potatoes.

It is well to remember, however, that the variety which is almost solely grown in this State, viz., the "Delaware," is a "first early" as to length of the growing period, and, being such a quick maturer, it is not to be expected that the starch content—and this is what the cook values in the potato—can be as high as in, say, the "Factor," which takes another six weeks in growth and the business of starch formation.

It is interesting to note the difference in "early" and "late" varieties of tubers, when cut lengthwise, when referring to the starch content of tubers.

Ripe specimens of each should be cut and compared, and it will be at once noticeable that the "early" variety will show semi-transparent streaks radiating from the centre and also a similar appearance around near the edges, under the skin. The intervening areas appear whiter and duller, this condition denoting a higher percentage of starch. "Late," *i.e.*, long-growing, slow maturing, varieties show this white opaqueness throughout with a consequently greater starch value.

In countries where potatoes are grown for industrial purposes, special attention is given to the varieties yielding a high percentage of starch being purchased according to their worth in this particular.

Experiments carried out some years ago in America with 30 varieties of potatoes grown there, demonstrated that the average starch content was 14.3 per cent. The richest in starch was the "Burbank," showing 17.7 per cent., and the lowest a kidney variety. Our own "Delaware" averages about 14 per cent., but is influenced, as are all potatoes, by the soil, methods of cultivation, and depth of planting. Deep planting and hilling, it is claimed, tend to a reduction in starch production.

Potatoes for manufacturing purposes are not grown in this State, although in Victoria a small factory has been erected with a view to using

undersized and reject tubers. At Kendenup dehydration of potatoes has been employed and the product has been particularly suitable for use on out-back stations and in localities where the fresh tuber is hard to obtain and harder to keep.

In Western Australia, where no facilities exist for the conversion of small and reject produce, growers are much better advised to cull all such out of their lines for table purposes and turn them into pork.

The extent to which this class of stuff operates against top prices when included in a consignment is not realised by the bulk of potato growers, and far greater attention can profitably be directed to this phase of the business.

The argument is often advanced that the good sells the bad, but the truth is the bad condemns the best.

With the cost of producing potatoes at its present level, it is unlikely that the manufacture of starch and alcohol from potatoes in Australia will be embarked upon. Even in glut seasons growers would not be over eager to accept 30s. per ton for their crops for this purpose, and this is the top rate in continental countries, and a continuity of supplies is, of course, a first consideration in an industrial venture.

CULTURAL NOTES.

With the earlier planted crops now appearing above ground, top-dressing, where followed, should not be delayed, particularly with the indications pointing to a distinct falling off in normal rains.

Harrowing should follow at once and the spike tooth cultivator kept busy as soon as the rows are discernible, to keep down weeds and conserve moisture.

As the crop progresses a watchful eye must be kept for any plants not true to type and variety, and these culled rigidly.

METEOROLOGICAL INFORMATION.

1925.

JUNE, 1925.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	68·9	80·9	48·0	40·5	7·48	3·93
Geraldton	71·1	80·6	54·3	44·7	6·82	4·71
Walebing	64·1	78·2	44·1	32·0	3·39	3·96
Perth	66·0	78·3	50·0	42·0	8·50	6·90
Kalamunda	67·2	80·0	50·9	43·5	8·69	8·09
Bunbury	65·0	75·8	48·5	37·2	6·08	7·21
Bridgetown	62·4	74·9	39·8	32·0	3·70	5·89
Albany	62·8	75·6	48·0	41·6	4·44	5·53
Merredin State Farm	63·7	77·3	43·0	32·2	1·47	1·85
Northam	65·2	79·1	43·7	34·5	3·35	3·50
York	65·6	76·8	45·7	33·0	3·30	3·37
Narrogin State Farm	61·2	73·5	43·4	33·3	2·63	3·72
Katanning	60·9	74·0	42·4	33·5	2·40	2·87
Cape Leeuwin ...	63·1	71·5	54·0	46·5	4·73	6·91

JULY, 1925.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	64·6	72·3	44·1	35·1	3·24	3·93
Geraldton	66·8	73·8	50·4	39·9	3·62	3·90
Walebing	59·8	66·0	38·9	31·0	1·08	3·59
Perth	62·1	69·0	45·1	37·0	6·89	6·44
Kalamunda	62·8	74·0	44·7	39·0	7·54	7·72
Bunbury	62·0	66·8	45·5	36·8	8·98	6·91
Bridgetown	58·8	65·0	38·2	30·5	4·84	5·73
Albany	59·6	65·4	45·7	36·0	4·73	5·46
Merredin State Farm	59·3	65·6	35·8	29·4	1·34	1·96
Northam	60·2	66·5	36·0	31·0	2·44	3·34
York	66·6	56·0	38·0	30·2	2·41	3·26
Narrogin State Farm	57·5	62·0	38·9	30·8	2·68	4·01
Katanning	56·9	61·8	40·0	30·0	2·12	2·96
Cape Leeuwin ...	60·7	64·2	51·6	47·0	5·99	7·12

AUGUST, 1925.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	68·1	74·1	43·8	35·3	1·06	2·81
Geraldton	70·0	77·3	49·6	42·6	1·33	3·00
Walebing	...	...	...	...	...	3·10
Perth	64·1	72·0	45·6	38·4	1·90	5·70
Kalamunda	63·8	69·7	42·5	37·0	1·63	6·97
Bunbury	64·3	71·2	41·7	37·2	1·72	5·52
Bridgetown	61·9	69·0	36·0	26·5	1·31	5·19
Albany	59·7	67·6	45·4	38·0	1·98	5·29
Merredin State Farm	...	...	37·9	28·2	1·83	1·55
Northam	62·3	70·7	38·2	32·2	0·26	2·64
York	63·9	70·2	37·9	31·0	0·41	2·91
Narrogin State Farm	59·8	67·0	38·1	30·8	0·83	3·34
Katanning	58·9	65·6	37·9	28·1	1·54	2·56
Cape Leeuwin ...	61·1	69·0	50·3	44·0	2·22	5·30

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF JUNE, JULY, AND AUGUST, 1925.

—	June.				July.					August.			
	3.	10.	17.	24.	1.	8.	15.	22.	29.	5.	12.	19.	26.
Sheep and Lambs	6,018	6,894	6,827	6,680	4,719	7,482	6,967	7,535	8,082	7,800	8,062	9,414	5,741
Cattle ...	648	834	794	499	1,151	1,049	1,048	1,087	690	660	1,070	1,261	451
Pigs ...	661	741	604	544	799	580	512	746	661	453	785	516	783

COMPARATIVE VALUES OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF JUNE, JULY, AND AUGUST, 1925.

—	June.				July.					August.			
	3.	10.	17.	24.	1.	8.	15.	22.	29.	5.	12.	19.	26.
Mutton	11	10¼	10½	10½	10½	10½	10¼	10½	10	10	10	9	10
Beef ...	8	7½	6½	6¼	6	5½	5½	6	6½	7	6½	6	6½
Pork ...	11¾	12	12	11¼	11¾	11¾	12	12	12	12½	12¾	12¾	11½
Bacon ...	10	9	9	8½	8½	8½	9½	9½	9½	9¾	10	10	10

MARKET REPORT.

Chaff.—Hereunder are detailed particulars of the approximate quantity of both wheaten and oaten chaff available for auction at the metropolitan chaff and grain auction sales held in Perth during the months of June, July, and August, also the minimum and maximum prices ruling for f.a.q. to prime wheaten chaff during those months:—

June—Quantity, 2,350 tons.
Minimum price for f.a.q. to prime, £6 5s. per ton.
Maximum price for f.a.q. to prime, £6 17s. 6d. per ton.

July—Quantity, 2,850 tons.
Minimum price for f.a.q. to prime, £6 5s. per ton.
Maximum price for f.a.q. to prime, £7 2s. 6d. per ton.

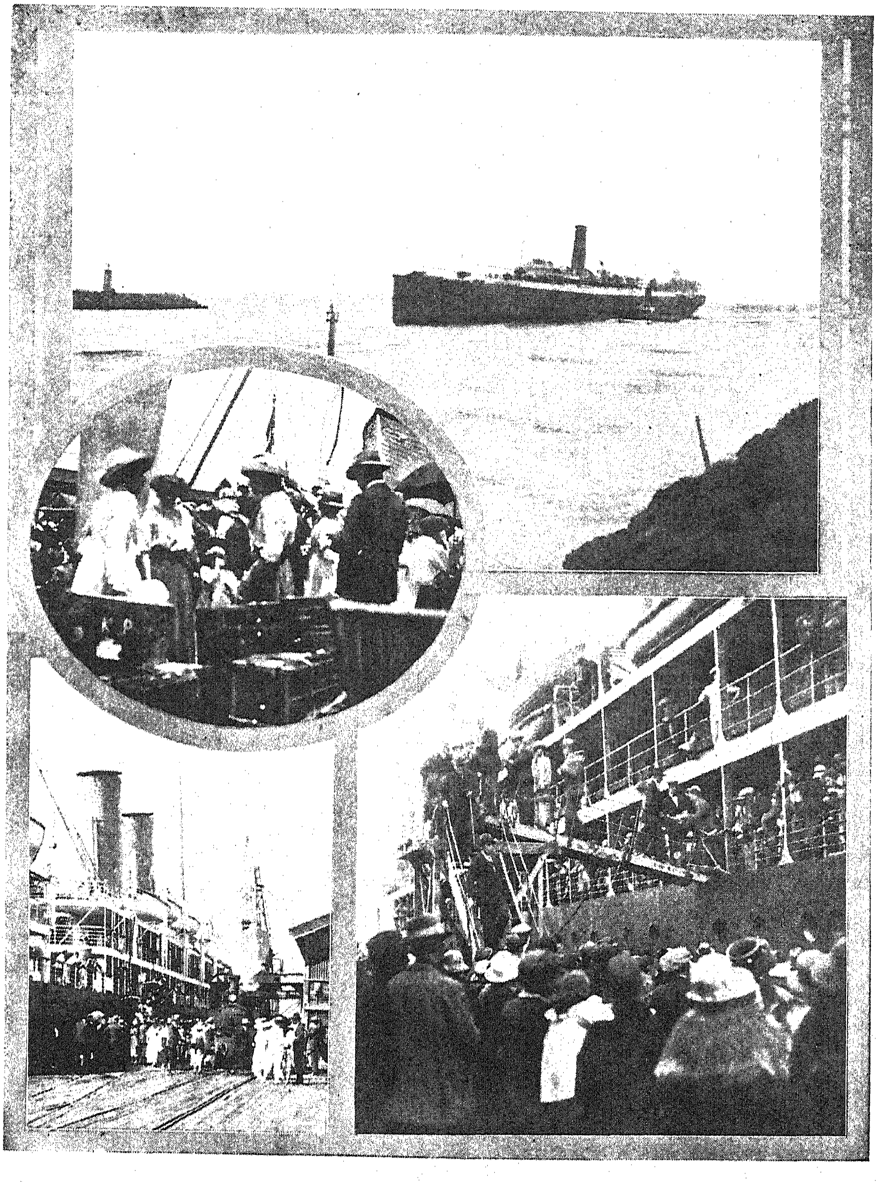
August—Quantity, 1,900 tons.
Minimum price for f.a.q. to prime, £5 15s. per ton.
Maximum price for f.a.q. to prime, £7 per ton.

Wheaten Chaff.—For the three months preceding June, the total quantity of chaff available in Perth was 8,550 tons against 7,100 tons for the last three months. The quantities received in June and July were up to normal, but it will be seen that supplies in August diminished considerably. This is accounted for mostly by the dry weather conditions experienced, farmers being very reluctant to market their surplus. During the last few days the market has firmed considerably, and up to £7 15s. per ton has been secured for prime samples. At time of writing this report (9-9-25) a little rain has fallen with indications of a good downpour setting in. The chaff market is still firm, but, of course, if the country is benefited with good rains it may have a slight easing tendency. However, it will yet be some time before the new hay is cut, and as there appears to be very little surplus of hay and chaff now held there is every likelihood of prices remaining satisfactory.

Oaten Chaff.—Although supplies were fairly plentiful during the months of June and July, in August supplies dwindled, and at the beginning of this month oaten chaff has been indeed very hard to procure. Consignments of f.a.q. arriving on this market during the last few days have realised £6 10s. per ton, and there is an excellent demand for all qualities, good mediums being worth £6 5s., and mediums, suitable for cow feed, £5 15s. to £6 per ton.

Oats.—Supplies during June and July were very plentiful, and, as predicted, the market eased, good heavy feeds being sold as low as 2s. 3d. per bushel. Owing to the dry spell experienced during August farmers ceased marketing. The result was that the market firmed, and at the time of writing good heavy feeds are worth 2s. 10½d. per bushel on the Perth market, and mediums 2s. 9d. to 2s. 9½d. We believe that stocks of oats held are heavy, and no doubt if good rains are experienced farmers will be inclined to market, and then, of course, values will be almost certain to ease.

Wheat.—The market is firm. Supplies arriving in Perth for sale at auction are meeting with ready sale, f.a.q. selling at from 6s. 4½d. to 6s. 5½d. per bushel. We should strongly advise farmers having any surplus to dispose of to consign to Perth for sale at auction.



Groupers landing at Fremantle.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

No. 20.—*The Pruning of Fruit Trees.* By J. F. Moody. Price 2s. 6d.
No. 46.—*Fruit Packing and Marketing and Exporting of Fruit.* By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—*The Poultry Keeper's Manual.* By G. Allman. Price 1s.
No. 83.—*Horticulture and Viticulture.* By A. Despeissis. Price 2s.
No. 5.—*Fruit Drying.* By J. F. Moody. Free.
No. 15.—*Root Rot.* By A. J. Despeissis. Free.
No. 49.—*The Feeding of Horses.* By Professor Paterson and G. L. Sutton. Free.
No. 57.—*Vermin Destruction.* By A. Crawford. Free.
No. 60.—*The Farmer's Clip.* By J. J. Mahood. Free.
No. 68.—*Flaying and Treatment of Hides.* By R. E. Weir. Free.
No. 72.—*The Potato: Its Cultivation, Pests, and Diseases.* By G. N. Lowe. L. J. Newman D. A. Herbert. Free.
No. 74.—*Tobacco Growing: Notes for Intending Planters.* By G. W. Wickens. Free.
No. 79.—*Sheep on the Wheat Farm and their Management in W.A.* By H. McCallum. Free.
No. 87.—*Sheep Feeding Experiments: State Farm, Chapman,* 1920. By G. L. Sutton and F. Vanzetti. Free.
No. 88.—*Light Land: Conference.* By G. L. Sutton. Free.
No. 90.—*Stock Waters: Standard for Composition of.* By E. A. Mann. Free.
No. 93.—*The Home Tanning of Sheep and other Skins.* By H. Salt. Free.
No. 94.—*The Dingo.* By B. W. Leake. Free.
No. 96.—*Poison Plants of W.A.* By D. A. Herbert. Free.
No. 99.—*Australian White.* By G. L. Sutton. Free.
No. 101.—*Cotton Cultivation.* By G. L. Sutton. Free.
No. 103.—*Kerosene Method for Eradicating the Zamia Palm.* By G. K. Baron-Hay. Free.
No. 104.—*Stickfast Flea.* By J. G. C. Campbell. Free.
No. 105.—*Pedigree Selection of Seed.* By G. L. Sutton. Free.
No. 106.—*The Red Legged Velvet Earth Mite.* By L. J. Newman. Free.
No. 107.—*Sudan Grass.* By G. L. Sutton. Free.
No. 109.—*Rape.* By G. L. Sutton. Free.
No. 111.—*Standard Wheat Varieties.* By G. L. Sutton and F. Vanzetti. Free.
No. 112.—*Automatic Device for Eradication of Stickfast Flea.* By G. Allman. Free.
No. 113.—*Picked Pieces (Classification of Clip).* Free.
No. 114.—*Blue Mould on Citrus Fruits.* By W. M. Carne. Free.
No. 115.—*The Value of Windmills for Pumping Water in W.A.* A. H. Scott.
No. 116.—*Spotted Wilt of Tomatoes.* W. M. Carne.
No. 117.—*Cream.* P. G. Hampshire.
No. 118.—*Pigs and Pig Raising.* P. G. Hampshire.
No. 119.—*Take-all of Wheat and Similar Diseases of Cereals.* By W. M. Carne and J. G. C. Campbell.
No. 120.—*Pastures in the South-West.* A. B. Adams. (Reprint from "Journal.")
No. 121.—*Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals.* W. M. Carne and J. G. C. Campbell.
No. 122.—*Fruit Fly. Description and Control.* L. J. Newman.
No. 124.—*Government Inspection of Wheat.* G. K. Baron-Hay. (Reprint from "Journal.")
No. 125.—*Buy Good Seed.* (Advice to Farmers.) W. M. Carne. (Reprint from "Journal.")
No. 126.—*The Rust of Cereals.* W. M. Carne and J. G. C. Campbell.
No. 127.—*Wheat Yields—Competitions.*
No. 128.—*Woolly Aphis Parasite (Aphelinus mali).* (Hald.) L. J. Newman. (Reprint from "Journal.")
No. 129.—*The Farm Horse: Hints on Feeding.* A. McK. Clark. (Reprint from "Journal.")
No. 130.—*Minerals and the Health of Cattle.* A. B. Adams. (Reprint from "Journal.")
No. 131.—*The Strength of Wheat and Flour.* R. G. Lapsley. (Reprint from "Journal.")
No. 133.—*Kikuyu Grass for Poultry.* G. L. Sutton. (Reprint from "Journal.")
No 134.—*Flag Smut of Wheat.* W. M. Carne. (Reprint from "Journal.")
No. 135.—*The Objects of Farmers' Trials.* G. L. Sutton. (Reprint from "Journal.")
No. 136.—*The use of the Scythe.* H. Campbell. (Reprint from "Journal.")
No. 137.—*Winter Trapping of the Fruit-fly.* L. J. Newman. (Reprint from "Journal.")
No. 138.—*Clearing Heavily-timbered Pastures.* A. B. Adams. (Reprint from "Journal.")
No. 140.—*Surface Draining.* A. R. Clifton. (Reprint from "Journal.")
No. 141.—*Breeding a Permanent Flock.* H. McCallum. (Reprint from "Journal.")
No. 142.—*The Plague Locust.* L. J. Newman. (Reprint from "Journal.")
No. 143.—*Zamia Palm and "Rickets" in Cattle—Method of Eradication.* A. B. Adams and G. K. Baron-Hay.

No. 144—*Ants as Pests.* J. Clark.
No. 145—*The Tuart Bud Weevil.* L. J. Newman and J. Clark.
No. 146—*Development of a Dairy Herd.* P. G. Hampshire.
No. 147—*Cultivation of the Potato.* G. N. Lowe.
No. 148—*Maize—The King of Fodder Crops.* G. L. Sutton.
No. 149—*Lucerne.* G. L. Sutton.
No. 150—*Subterranean Clover.* A. B. Adams.
No. 151—*Blow Fly Traps.* L. J. Newman.
No. 152—*Bee Diseases.* H. L. Cailes.
No. 153—*Lice and Tick in Sheep.* F. Murray-Jones L. J. Newman, and H. McCallum.
No. 154—*Branding the Wool Bale.* G. L. Sutton and N. Davenport.
No. 155—*A simple Dry Pickler.* G. L. Throssell.

The following publications may be obtained from the Department of Agriculture, Perth, on application, or will be sent post free to any address in this State on receipt of a remittance for the amount stated:—

The Handbook of Horticulture and Viticulture of Western Australia, by A. Despeissis, M.R.A.C.: This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible it has been reduced to 2s.

The Pruning of Fruit Trees, by J. F. Moody, Fruit Industries Commissioner: This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price 2s. 6d.

Fruit Packing and the Marketing and Exporting of Fruit, by J. F. Moody, Fruit Industries Commissioner, and J. Ramage, Packing Instructor: This publication contains invaluable information on packing and grading fruit for local and export markets. It is freely illustrated, and no fruit-packing shed should be without a copy. Price 1s. 6d.

The Poultry Keepers' Manual, by George Allman, Government Poultry Expert: This is a most useful and valuable book, not only for beginners, but to all those who keep fowls for pleasure and profit. It deals fully with all matters connected with the industry, including Breeding, Feeding (for stock birds or egg production), Incubating, Brooding and care of chicks, Marketing (eggs and poultry), and all matters of use to the poultry-keeper. It also fully describes symptons of various ailments and diseases and simple treatment for same, and, as the book was written to suit *local conditions,* every poultry-keeper should have a copy by him. Price, 1s.

Agricultural Bank.

ADVANCES TO FARMERS.

The Agricultural Bank, which is a State institution and is worked under a Special Act, was founded with the object of making advances to settlers for the purpose of assisting and encouraging them during the early years of the development of their farm.

The Agricultural Bank makes advances on approved securities to approved persons engaged in the business of farming or grazing, or in horticultural pursuits, to an amount not exceeding £2,000.

Every application must be made on the prescribed form, and must contain full particulars of the purposes for which the advance is required.

Where an advance is approved for effecting improvements on the borrower's land, such advance is made by progress payments as the work progresses.

Developmental advances are usually made for clearing, fencing, ringbarking, and water supply, and are made to the full value of the work done after it has been inspected and certified to by a responsible officer. After a reasonable stage of development has been reached, and providing the general progress of the settler is considered satisfactory, limited assistance is granted towards building (maximum £250), and money is provided to assist in the purchase of stock and machinery, the maximum amount for this purpose, except in special cases, being £150.

Interest is charged at the rate of seven per cent. per annum, and repayment of principal extends over a period of 30 years, except in the case of stock or machinery advances which have a currency of eight years only.

The security required by the Bank is a first mortgage over the lands on which the advance is to be expended, and such lands may consist of:—

(a) Holdings in fee simple; or
(b) Holdings under Special Occupation Lease or Conditional Purchase from the Crown; or
(c) Homestead Farms; or
(d) Such other real or leasehold property as the Trustees may think fit.

Mortgages are prepared free of charge; but borrowers are required to pay the statutory costs of registration.

Interest only on the advances made is charged during the first 10 years, and repayment of the capital does not commence until the eleventh year.

Application may be for sums of £25, or any multiple thereof, not exceeding £2,000. Each application must be accompanied by a valuation fee of one per cent of the amount applied for No refund of fee is allowed after an inspection of the security has been made.

The leases, or Occupation Certificate, as the case may be, together with the fees, must be in the possession of the Bank before a mortgage can be prepared.

REGISTRATION FEES.

	s.	d.
For each Conditional Purchase, Homestead Farm, or Grazing Lease under the Land Act	5	0
For each Freehold Lot or Crown Lease	10	0
For every additional Freehold Lot or Crown Lease	2	0

STAMP DUTY.

	s.	d.		s.	d.
Up to £50	1	3	From £301 to £400	10	0
From £51 to £100	2	6	„ £400 „ £500	12	6
„ £101 „ £150	3	9	Stock Bill of Sale, up to £50	5	0
„ £151 „ £200	5	0	„ „ over £50	10	0
„ £201 „ £250	6	3	Machinery Bill of Sale, up to £50	5	0
„ £251 „ £300	7	6	„ „ „ over £50	10	0

Intending borrowers are requested to note that no advances are made against improvements effected prior to date of application. Applications should, in every instance, be lodged prior to commencement of work, and moneys are then paid over in progress payments as the work proceeds.

IMPROVED FARMS.

The Trustees of the Agricultural Bank have, from time to time, improved farms on their hands which have been abandoned for various causes, or have been taken over as security for loans. These farms are available for purchase, and extended terms are given for payment of the amount. They often offer to intending settlers an opportunity of obtaining an improved holding, ready for occupation, at a cheap rate, without having to undertake the preliminary work of clearing and fencing. The properties, when obtainable, are advertised in the "Government Gazette"; but anyone wishing for particulars of such farms as may be available should make application to the Managing Trustee of the Agricultural Bank. Particulars will then be sent, and an inspection can be made by the intending settler to ascertain whether the same is suitable for his requirements.

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(Second Series) Vol. 2.—No. 4.

Western Australia.

JOURNAL

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OF

WESTERN AUSTRALIA

By Direction of

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FIELD DAY AT THE MERREDIN STATE FARM.

THE EDITOR.

I write for those interested in Farmers' Field Days, and if there is one farmer who is not interested in these valuable demonstrations I fear he is suffering from an intellectual myopia sadly in need of relief.

What is a Farmers' Field Day?

It is an annual exposition of results from patient effort harnessed to trial, experience, experiment and condition; an education in a nutshell; bovrilised farm science. It is a gift from the Government of the day to its husbandmen of knowledge painstakingly acquired, and a plan scientifically designed for the opening up and development of fields and pastures to the limit of the State's soil and climatic capacity. It is also a sign post at the crossroads of success and failure.

If anything were needed to emphasise the popularity of this praiseworthy institution, it was supplied by the throng of interested spectators who foregathered at the Merredin State Farm on October the 16th. Long before noon the farmyards were crowded with visitors from far and near, and as the day wore on and every description of conveyance attached itself to the muster and unloaded its human freight, there must finally have been over 200 motor cars and upwards of 1,000 people assembled.

Although the social aspect of the gathering claimed its meed of prominence, the desire to acquire useful information on agricultural methods was easily uppermost in the minds of those present, and, following a brief opening ceremony by the Minister for Agriculture, Hon. M. F. Troy, a speedy exodus was made for the plots.

The close attention paid to the Director of Agriculture, Mr. Geo. L. Sutton, when explaining the nature and results of different experiments, and the appreciation frequently expressed over the work carried on at the farm, must have been extremely gratifying to the manager and his staff.

The first plot visited was devoted to experiments with fodder plants, of which lupins held pride of place. Late last year fifty varieties of these plants were imported for experimentation, but the results obtainable could not be accepted as reliable. This year the trials are being made from locally grown seed, and it was noticeable that most of the plants looked very promising indeed. Mr. Sutton has been much impressed with the value of this fodder for sheep raising, and stressed as one of its advantages the fact that while sheep did not readily turn to it in its green state, preferring the weeds and natural grasses between the planted rows, later on, when the green feed dies off, the grain of these lupins are relished by the flocks, and they thus provide a natural, cheap and easy method of fodder conservation. Apart from this benefit is the fact that the cultivation of lupins supplies a very desirable increase of nitrogen in the soil.

Minister addressing the Assemblage.

Some experiments with lucerne were attended with partial success, but in explaining these the demonstrator was careful to remind his hearers that the limited rainfall period in the Eastern wheat belt was scarcely conducive to the extensive cultivation of this class of fodder, although it had been proved that small plots could be successfully grown for special purposes. Subterranean clover, too, was in evidence, the plants appearing vigorous and healthy. It is not considered that this perennial can be usefully sown in the wheat belt, being more eminently suited for the South-Western Districts; and regarding its potency for the development of the dairying industry, it was averred that this would do for the South-West of the State what paspalum had accomplished for the North Coast of New South Wales.

Naturally enough the chief interest centred in the examination of the wheat and oat experimentation plots, and as the Director moved from land to land explaining the merits and demerits of type and method of cultivation—this latter embracing a multiplicity of tests including early and late ploughing, mulching, late seeding, rate of superphosphate, rate of seeding, seasonable planting, and "Ephos" phosphate experiments—the multitude

evinced a lively sense of its appreciation, now crowding round the speaker eager to catch every syllable, then straying among the plots examining head and growth of plants; following on again in a long strung-out procession leisurely discussing the pros and cons of the lecturette, and finally spurting forward to be up with the van at the next point of discourse.

Speaking on oat cultivation, Mr. Sutton declared that the farmers of this State were using seed quite as pure as any sown in the whole Commonwealth. As regards wheat, much had been accomplished by concentrating attention on the evolution of varieties from the best stock most suitable to our climate. No other new variety of wheat had achieved the same success as our Nabawa, both in respect to its rust-resisting and flour-milling qualities. Some Agricultural Societies inclined towards an advocacy of red wheat, but with this he was out of sympathy. In the markets of the world Australian wheat held a high place owing to its brightness, bloom and whiteness, which rendered it so valuable for blending. Red wheats introduced would lead to a declension of its reputation. A buyer sampling Australian wheat with an admixture of red variety would conclude it was not pure, but adulterated, and in consequence would turn away from it, or at best accept it as an inferior product with a mental precaution against a waning standard. Therefore why cultivate varieties which would reduce the commercial value of those in general cultivation without increasing the yield or giving other compensating advantages. In speaking of artificial manures the Director stated that our own State's manufacture of superphosphate had given the best results over an exhaustive series of tests. One questioner avowed he had obtained better returns from the use of Ephos phosphate, but Mr. Sutton did not dispute the contention. Unusual conditions had often given strange results in State Farm experiments, results which were conflicting with general experience, and so to determine the truth of these things experiments were carried out with eight successive repetitions instead

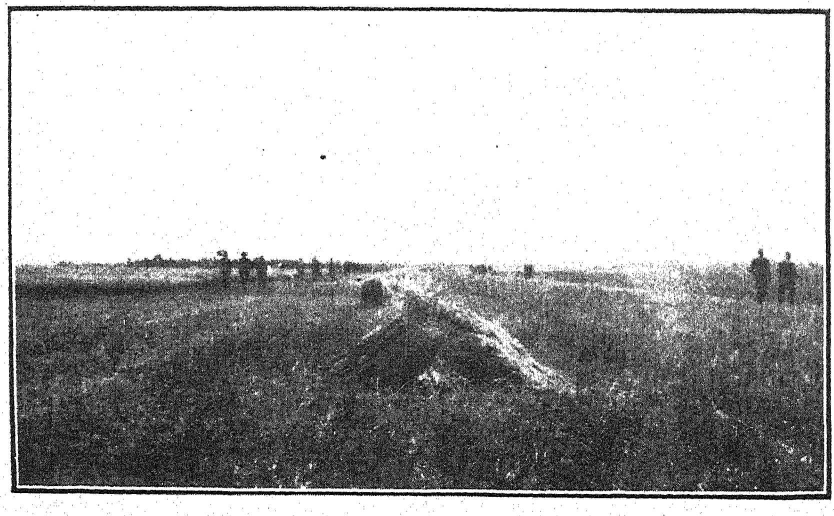
The Crowd "Listening-in."

of two as had been hitherto been the practice, and the final verdict, as stated, had been indubitably in favour of our superphosphate.

Referring to rust and smut prevention Mr. Sutton strongly counselled the dry-pickling method. With wet pickling methods farmers had sown 60lbs. of seed per acre in anticipation of a good return, but, as a matter of

Up with the Van.

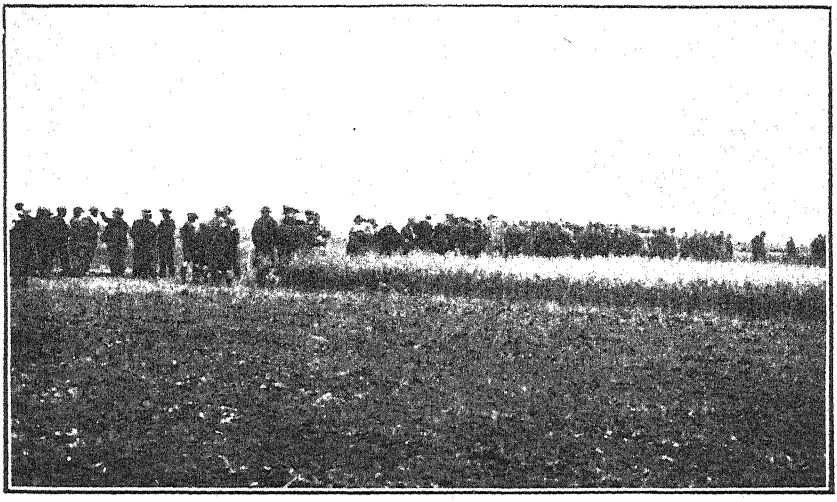
fact, only about 50 per cent. of this would germinate with the wet pickle as used by the average farmer, and, in consequence, the actual rate was only equal to about a 30lb. sowing. It did not matter what their machines had cost, it were better to scrap them for old iron or copper and revert to the



A Long-strung-out Procession.

dry-pickling method, which experience had proved to be the better and more effective process. 45lbs. of seed to the acre had proved the best quantity for sowing.

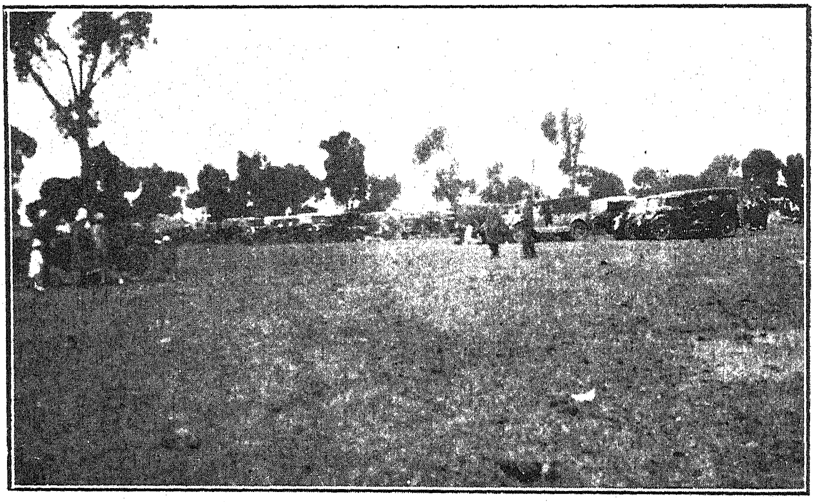
In addressing the gathering at the conclusion of the proceedings, the Minister for Agriculture, Hon. M. F. Troy, expressed his pleasure at finding such a large gathering of farmers with their wives and families, many of whom had journeyed long distances to be present, because it showed an interest in the experiments very encouraging to him as Minister, and to the officers of the Department. It was not merely the reward of remuneration that the officers worked for, it was the joy of the working and the desire to see their efforts appreciated and bringing benefit to the State. No man who had visited the farm that day could return home without feeling that he had profited by his visit. The crops inspected were not up to standard, owing to the light rainfall throughout the whole area of the wheat belt, only



Discussing the Pros and Cons.

5½ inches of rain having fallen through the growing period, with but 24 points in August and 90 points in September. The important thing was they had proved what could be done with a paucity of rainfall, and it was perhaps a blessing for demonstrating purposes they had such a meagre fall of moisture this year. At Merredin during the growing period the rainfall had been limited to little over 5½ inches. Had this happened 12 years ago, before such experimentation as they had seen had developed and proved the value of sound methods of cultivation, it would have been a calamity, a bad omen that might easily have spelled ruin and the abandonment of wheat cultivation in these areas. With selected seed-wheat and modern methods of cultivation a different complexion had been put upon everything. He thought the crops, although they appeared to suffer from the dry spell, would return a fair average yield and proved what could be done by good farming methods with a 5½-inch rainfall. We should no longer fear for the future of the wheat belt after this experience, which

was that of only one year out of ten, and if we continued to suffer only one bad year in ten, and accomplish such results in that one bad year, the future was roseate indeed. He was sanguine that this State would produce wheat crops many miles east of the existing wheat area, and convinced we were on the verge of opening up east of Wongan Hills Railway an area of wheat country extending 70 miles. With such experiments as were being carried out on the State Farms it was confidently hoped that Western Australia would become the premier wheat-growing State in the whole of the Commonwealth. This year experiments at Kalgoorlie indicated they could grow wheat there from which a return could be obtained. It would not be profitable, nor could that be expected under the existing conditions; but Nabawa and Gluyas Early varieties had produced sufficient grain despite the dry season, and with less than 2½ inches during the growing period, to warrant these plots being harvested.. He would not prophecy that Kalgoorlie would



A Section of the Park.

yet be a wheat-growing centre, but if they could farm at Merredin on a 5½ inch rainfall, as they had done, then the possibilities were not circumscribed. But the Government believed there was a limit beyond which it would be unwise to send people farming. In Western Australia the Government had financed most of the settlers on the land, as well as many other industries. They thought it better to spend a few thousand pounds to test the country further East before allowing people to go there and then have to spend perhaps half a million pounds with disastrous results to themselves and the State. With a view to determining this limit beyond which they could not go the policy of experiment farms would be further pursued, and it was proposed to establish four more farms—not experiment farms in the sense that Merredin was one—but purely with regard to tillage and rainfall. If these proved that wheat could be grown at a profit then it would be time to finance farmers on these lands.

Referring briefly to the Wongan Hills Light Lands Farm Mr, Troy said that although this land was taken up only last year, 1,000 acres had been

fallowed and put in crop around May last. He thought it safe to say that these light lands, or sand plain farms, to be more correct, presented a more pleasing appearance to-day than did the Merredin State Farm crops, and it was really remarkable to see what had been done in so short a space of time. The ultimate results could only be proved by experiment over a number of years, and he hoped these experiments would result in the light lands of Western Australia, of which we possess 9,000,000 acres adjacent to the railways, proving capable under expert treatment of being farmed for a paying crop or for carrying stock. He further hoped that next year the people would throng there as they had at Merredin, and witness what was being done in that locality, and what was being accomplished by the Government and the Agricultural Department under the Experiment Farms Scheme.

CITRUS BROWN ROT.

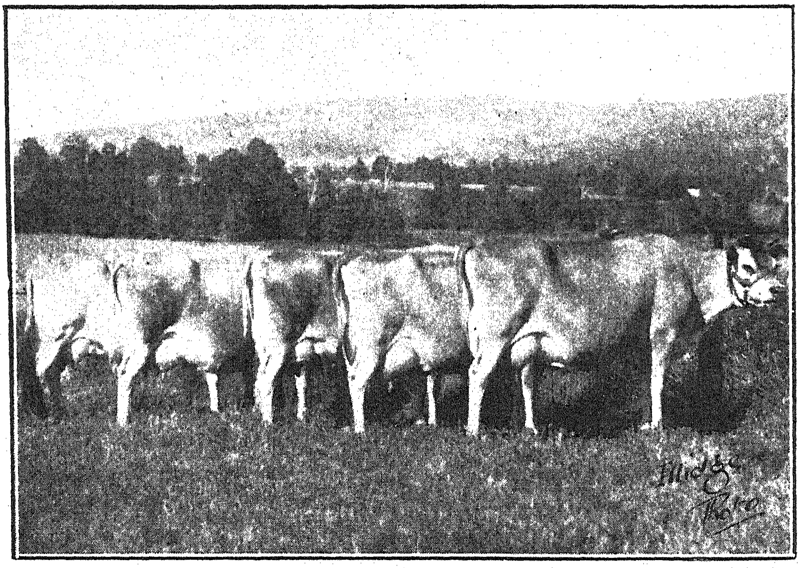
IMPORTANT LOCAL RESEARCH.

What was described by the Director of Agriculture (Mr. G. L. Sutton) as the "turning of the tide" in pathological research from being exclusively conducted in the Eastern States to its being triumphantly initiated in this State, was a paper on the brown rot of citrus in Australia, read at the monthly meeting of the Royal Society on Tuesday evening by Mr. W. M. Carne the Economic Botanist and Plant Pathologist of the Department of Agriculture. The paper dealt exhaustively with the investigations on what was thought to be an American fungus infecting local citrus orchards since 1917, but which showed decided differences from that form, and was subsequently proved by the author to be an entirely new species. He considered also that it was this fungus and not the American species which was found in the Eastern States, and recent Portuguese research indicated that it was the common brown rot of citrus in the Mediterranean countries as well, and not the American brown rot as previously supposed. Mr. Carne showed a number of lantern slides illustrating the life history of the fungus, and mentioned that it could be easily kept in check by thoroughly spraying the lower parts of the tree, up to a height of 5ft., with Bordeaux or Burgundy mixtures, not later than the end of April. The proviso as to the height of spraying was necessary to preserve from the effects of the spray the useful fungi which kept scale in check.

COST OF FEEDING COWS UNDER OFFICIAL TEST AND PROFIT ON SALE OF PRODUCE AS MILK OR FAT.

P. G. HAMPSHIRE,
Dairy Expert.

Following on the policy established last year, complete figures are supplied giving particulars of the average cow production of each of the pure bred herds entered under official test in Western Australia for the year ending 30th June, 1925, together with the value of butter milk, whole milk, skim milk, and the actual cost of feed which the cows consume. In addition to the value of the production if sold as butter fat to the factory—after deducting an allowance of skim milk fed to calf and crediting the cow with the balance at 2d. per gallon—is the value of each cow's produce if sold as fresh milk. This latter factor has been provided for in view of the fact that certain stud masters who are submitting their herds to the official test are producing for sale as fresh milk.



Profitable Pure-bred Dairy Cows.

A group of five registered pure cows, owned by Mr. R. H. Rose, Burekup, W.A.

273 DAYS TEST.

—	Herd Book No.	Milk.	Average Test.	Butter Fat.	Butter.	Age.	
		lbs.	%	lbs.	lbs.	years.	mths.
Carnation of Dardanup...	9,995	10,788	5·57	600·99	724·08	5	11
Maranora of Tellaraga ...	6,707	11,509	5·04	580·48	699·37	7	2
Fairy of Dardanup ...	8,942	11,235	4·80	539·41	649·89	6	4
Jean II. of Grass Vale ...	9,996	8,701	5·84	508·93	613·16	2	9
Campanile's Maid of Garden Hill	8,935	9,235	5·53	511·18	616·12	10	5

HERDS, IN ORDER OF MERIT, AS PRODUCERS OF BUTTER FAT.

CHART 1.

Columns.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Herd.	Average Fat per Cow for period of 9 months.	Average Skim Milk per Cow for period.	Value of Fat for period at 1s. 5½d. per lb.	Value of Skim Milk for period at 2d. per gallon.	Average Value of Fat and Skim Milk per Cow for period	Cost of Feed per Cow for period.	Nett Profit per Cow for period through sale of Fat.	Value of Whole Milk at 1s. 3d. per gallon allowing for rearing calf.	Profit per Cow by sale of Fresh Milk at 1s. 3d. per gallon.	Cost of Feed for 100lbs. of Fat.	Cost of Feed for 1 gallon of Milk.
	Pounds.	Gallons.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Pence.
A	439·75	469	32 1 3	3 18 2	35 19 5	14 6 19	21 12 7	35 6 2	20 19 4	3 5 2	5·28d.
B	354·19	427	25 16 6	3 11 2	29 7 8	11 4 10	18 2 10	31 17 2	20 12 4	3 3 6	4·44d.
C	335·60	388	24 9 5	3 4 8	27 14 1	11 16 3	15 17 10	29 9 9	17 13 6	3 10 3	5·04d.
D	380·26	512	27 14 6	4 5 4	31 19 10	16 2 10	15 17 0	36 17 4	20 13 6	4 4 11	5·52d.
E	326·05	368	23 15 5	3 1 4	26 16 9	11 7 4	15 9 5	28 5 6	16 18 2	3 9 9	4·92d.
F	323·47	428	23 11 9	3 11 4	27 3 1	14 14 4	12 8 9	31 9 0	16 14 8	4 11 1	5·76d.
G	312·57	312	22 15 9	2 12 0	25 7 9	14 13 0	10 14 9	25 2 4	10 9 4	4 13 7	7·08d.
H	277·55	263	20 4 9	2 3 10	22 8 7	12 8 7	10 0 0	21 19 9	9 11 2	4 9 5	6·72d.
I	208·37	303	15 3 10	2 10 6	17 14 4	8 16 4	8 18 0	22 0 2	13 3 10	4 4 9	4·32d.
J	297·80	480	21 14 4	4 0 0	25 14 4	17 0 7	8 13 9	34 3 8	17 3 1	5 14 3	6·12d.
K	357·20	727	26 0 11	6 1 2	32 2 1	24 6 9	7 15 4	48 18 6	24 11 9	6 16 4	6·36d.
L	252·99	364	18 8 11	3 0 8	21 9 7	13 16 10	7 12 9	26 17 8	13 9 10	5 9 5	6·12d.
M	270·30	570	19 14 4	4 15 0	24 9 4	19 17 4	4 12 0	38 16 3	18 18 11	7 7 2	6·36d.
N	209·86	299	15 6 0	2 9 10	17 15 10	15 9 7	2 6 3	22 11 3	7 1 8	7 7 5	9·72d.
Averages ...	308·59	407	22 10 0	3 7 10	25 17 10	14 13 2	11 4 8	30 10 5	15 9 5	4 18 1	6·15d.

It will be noted that each column in Chart 1 has been numbered.

Column 1 shows the average number of pounds of fat produced per cow in each herd.

Column 2 shows the average number of gallons of skim milk per cow after deducting 10 per cent. from the production of the cow as cream and allowing 180 gallons per cow for feeding the calf.

Column 3 shows the value of each cow's average production of butter fat at 1s. 5½d. per lb. This was the average nett price paid by the butter factories of Western Australia for the year ending 30th June, 1925.

Column 4 shows the value of the available skim milk after making due allowance for feeding calf and deduction as cream at 2d. per gallon.

Column 5 shows the total value of butter fat and skim milk per cow at price previously indicated.

Column 6 shows the actual average cost of feed consumed by each member of the herd. In this respect careful check throughout the year has been made by the official testers.

Foodstuffs produced on the farm are taken at farm cost values. Concentrated foods which are purchased are taken at the average price ruling throughout the year.

Column 7 shows profit per cow by the sale of butter fat and the value of the surplus skim milk for pig-feeding, after deducting the cost of feeding as shown in Column 6.

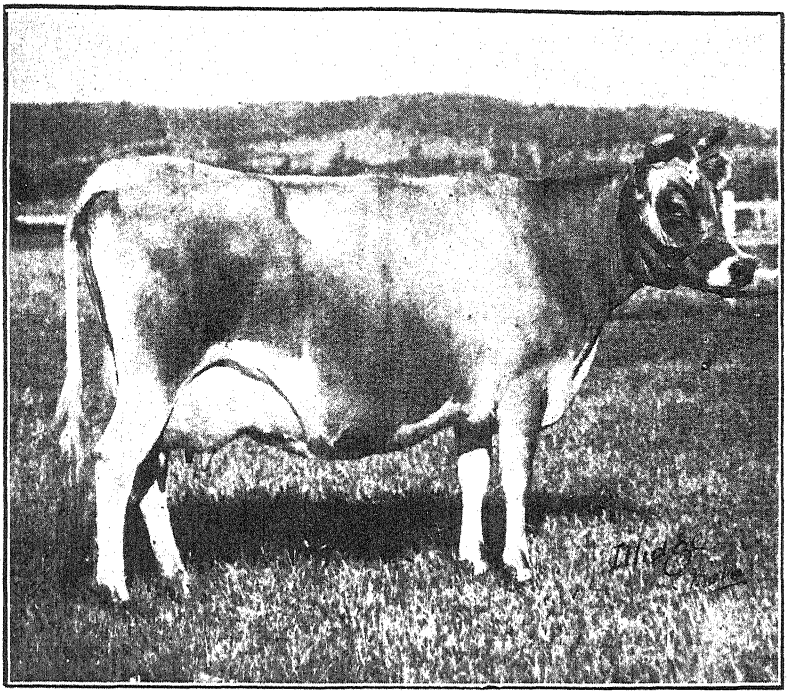
Column 8 shows the value of the milk production of each cow in the herd if sold at 1s. 3d. per gallon, after deducting 45 gallons of whole milk and 135 gallons of skim milk for calf-feeding and crediting the cow with the fat skimmed from the milk which would be obtained from the 135 gallons at 1s. 5½d. per lb.

Column 9 shows the profit per cow for sale of milk at 1s. 3d. per gallon after deducting feed costs as shown in Column 6.

Note.—Certain herds under test are situated near the city and most of their feed is purchased, and, in the circumstances, costs are high. On the other hand, it may be mentioned that these dairymen receive up to 1s. 9d. per gallon for the sale of the milk.

Column 10 shows cost of feed per 100 lbs. of butter fat produced, and enables the reader to judge, not only the cows but the owner, as the cost of producing 100 lbs. butter fat has a bearing on not only the animals but the manner in which they have been fed.

Column 11 shows cost of feed per 1 gallon of milk produced. The figures in this column enable the reader to judge the feeding and production of each cow on the basis of the production of 1 gallon of milk.



Jean II., of Grass Vale, No. 9996, A.J.H.B.

A high-producing Senior two-year old Jersey cow, owned by Mr. R. H. Rose, "Grass Vale," Burekup, W.A.

PRODUCTION UNDER OFFICIAL TEST FOR 365 DAYS.

Age at commencement of Test.		Milk.	Average Test.	Butter Fat.	Butter.
years.	months.	lbs.	%	lbs.	lbs.
2	9	11,181	6·04	676·22	814·72

AVERAGES OF ALL COWS UNDER TEST.

Chart 2.

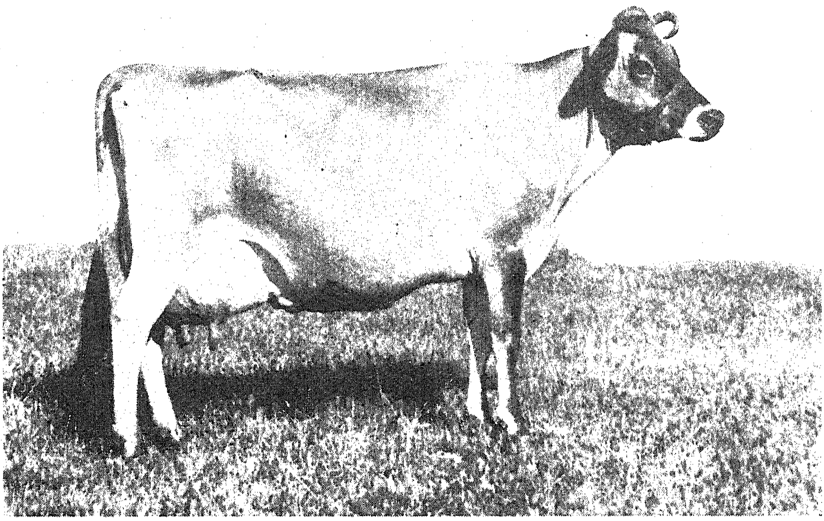
1. 652 gallons of milk and 308.59 lbs. butter fat per cow.
2. 407 gallons of skim milk per cow.

	£	s.	d.	
3. Value of butter fat at 1s. 5½d. per lb.	22	10	0	per cow.
4. Value of skim milk available for pig-feeding ..	3	7	10	„
5. Total credits to cow for sale of butter fat and skim milk	25	17	10	„
6. Cost of feed for period	14	13	2	„

Chart 2—continued.

		£ s. d.	
7.	Profit through sale of fat, after deducting feed costs	11 4 8	per cow.
8.	Value of whole milk if sold at 1s. 3d. per gallon	30 10 5	"
9.	Profit by sale of fresh milk at 1s. 3d. per gallon after deducting cost of feed	15 9 5	"
10.	Average cost of feed per 100 lbs. fat produced ..	4 18 1	"
11.	Average cost of feed per 1 gallon of milk produced	6.15d.	per gallon.

In regard to the above, the figures given represent the whole of the cows submitted to official test which have completed the nine months' test, and includes cows which have failed to pass the production standard.



Jersey Cow, "Maranora of Tellaraga," 6707, A.J.H.B.
Owner R. H. Rose, "Grass Vale," Burekup, W.A.

Age.		Milk.	Average Test.	Butter Fat.	Commercial Butter.	No. days under Test.
years.	months.	lbs.	%	lbs.	lbs.	
7	2	11,509	5·04	580·48	699·37	273

HERDS, IN ORDER OF MERIT, AS PRODUCERS OF MILK.

CHART 3.

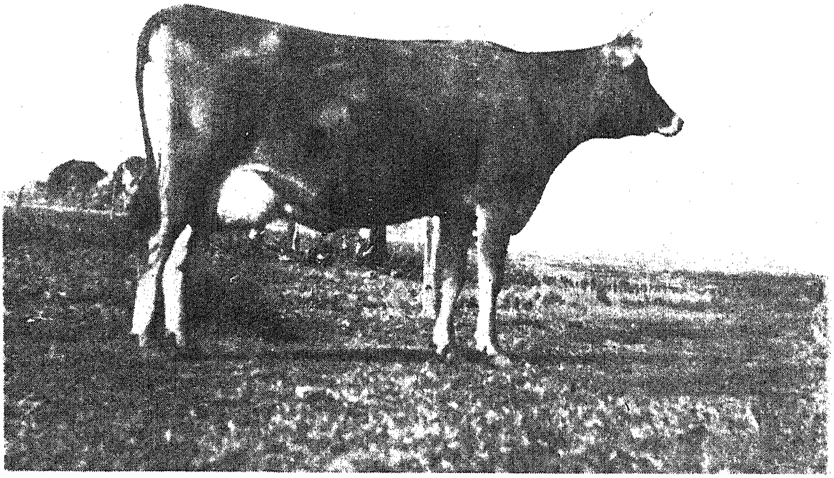
Herd.	Milk. Average Gallons.		Fat. Average Pounds.	Cost of Feed per Cow.	Profit, as Milk.	Profit, as Fat.	Cost to produce 100lbs. Fat	Cost to produce 1 gallon Milk.
				£ s. d.	£ s. d.	£ s. d.	£ s. d.	Pence.
K	1,007	(1)	357·20	24 6 9	24 11 9	7 15 4	6 16 4	6·36
A	721	(5)	439·75	14 6 10	20 19 4	21 12 7	3 5 2	5·28
D	768	(3)	380·26	16 2 10	20 13 6	15 17 0	4 4 11	5·52
B	674	(7)	354·19	11 4 10	20 12 4	18 2 10	3 3 6	4·44
M	833	(2)	270·30	19 17 4	18 18 11	4 12 0	7 7 2	6·36
C	631	(8)	335·60	11 16 3	17 13 6	15 17 10	3 10 3	5·04
J	733	(4)	297·80	17 0 7	17 3 1	8 13 9	5 14 3	6·12
E	608	(9)	326·05	11 7 4	16 18 2	15 9 5	3 9 9	4·92
F	675	(6)	323·47	14 14 4	16 14 8	12 8 9	4 11 1	5·76
I	536	(12)	208·37	8 16 4	13 3 10	8 18 0	4 4 9	4·32
L	604	(10)	252·99	13 16 10	13 0 10	7 12 9	5 9 5	6·12
G	546	(11)	312·57	14 13 0	10 9 4	10 14 9	4 13 7	7·08
H	492	(14)	277·55	12 8 7	9 11 2	10 0 0	4 9 5	6·72
N	532	(13)	209·86	15 9 7	7 1 8	2 6 3	7 7 5	9·72
Averages	652		308·59	14 13 2	15 9 5	11 4 8	4 18 1	6·15

Points of interest in connection with Chart 3 are:—

The most profitable milk-producing herd is the fourth lowest profitable fat-producing herd.

The second highest milk-yielding herd is the second lowest profit-making butter fat herd, and is the fifth highest profit-making milk-producing herd.

The fourth highest profitable milk-producing herd is the seventh highest milk-yielding herd.



Jersey Cow, "Girlie of Sarnia," 9992, A.J.H.B.
Owner D. Malcolm, "Sarnia," Wagin, W.A.

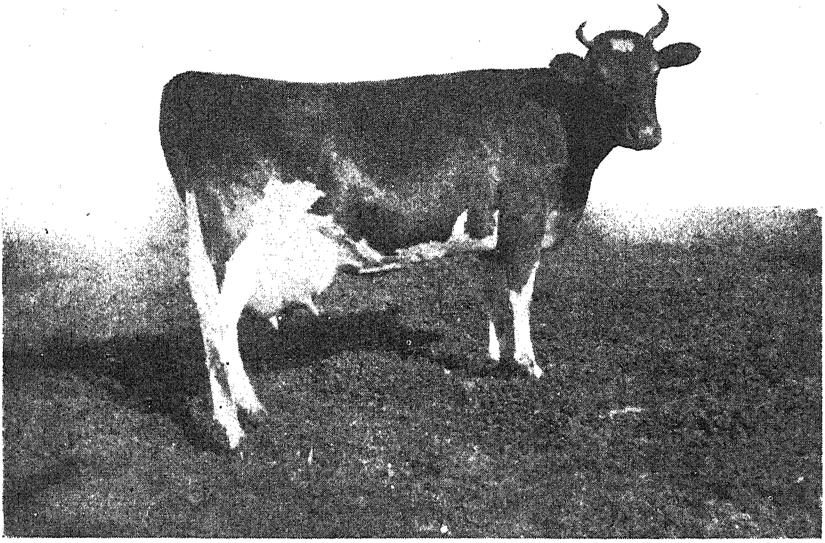
Age.		Milk.	Average Test.	Butter Fat.	Commercial Butter.	No. Days under Test.
years.	months.	lbs.	%	lbs.	lbs.	
5	9	12,750	5·17	660·00	795·18	365

HERDS, IN ORDER OF MERIT, SHOWING COST OF FEED PER 100LBS. FAT.

CHART 4.

Herd.	Cost of Feed for 100lbs. Fat.	Under Average.	Over Average.
	£ s. d.	£ s. d.	£ s. d.
B	3 3 6	1 14 7	...
A	3 5 2	1 12 11	...
E	3 9 9	1 8 4	...
C	3 10 3	1 7 10	...
I	4 4 9	0 13 4	...
D	4 4 11	0 13 2	...
H	4 9 5	0 8 8	...
F	4 11 1	0 7 0	...
G	4 13 7	0 4 6	...
L	5 9 5	...	0 11 4
J	5 14 3	...	0 16 2
K	6 16 4	...	1 18 3
M	7 7 2	...	2 9 1
N	7 7 5	...	2 9 4

Average of all Herds ... ... £4 18s. 1d.



Guernsey Cow, "Velvet of Wollongbar," 774, G.H.B.
Owner Department of Agriculture, Denmark Stud Farm, W.A.

This cow has produced 56lbs. of milk, testing 4.8 per cent in 24 hours.

HERDS, IN ORDER OF MERIT, SHOWING COST OF FEED PER GALLON OF MILK PRODUCED.

CHART 5.

Herd.	Cost of Feed per gallon of Milk.	Under Average.	Over Average.
	Pence.		
I	4·32	1·83	...
B	4·44	1·71	...
E	4·92	1·23	...
C	5·04	1·11	...
A	5·28	·87	...
D	5·52	·63	...
F	5·76	·39	...
L	6·12	·03	...
J	6·12	·03	...
M	6·36	...	·21
K	6·36	...	·21
H	6·72	...	·57
G	7·08	...	·93
N	9·72	...	3·57

Average of all Herds ... ... 6·15d.

Results show that the Friesian and milking Shorthorn herds are the most profitable milk-producing herds, while the Jersey and Guernsey herds show definitely that they are the most profitable fat-producing herds. In three instances of Jersey and Guernsey herds it is found that there is a

greater profit in selling their produce as butter fat than in selling their produce as fresh milk at ruling market rates. In other Jersey and Guernsey herds there is only a slight margin of profit shown in the sale of their produce as fresh milk as against the sale of butter fat.

Other points brought out in connection with the data available show that the cheapest feeders are not the greatest profit-makers. Cows fed on silage are the cheapest feeders.

It will be noted that the average profit per cow of all cows submitted to the test, including those which failed to pass the standard of production, shows a net profit per cow over cost of feeding of £11 4s. 8d. per lactation period of nine months. To this must be added the value of a pure bred yearling calf.

The data available again conclusively proves the commercial value of the pure bred cows tested in Western Australia.

PRAYER OF A HORSE.

To my master I offer my prayer: Feed me; give me water to drink; care for me. When the day's work is done provide me with shelter, a clean dry bed and a stall wide enough for me to lie down in comfort. Talk to me! Your voice often means as much to me as the reins. Pet me sometimes, that I may serve you the more gladly and learn to love you. Do not jerk the reins and do not whip me when going uphill. Never strike me, beat or kick me when I do not understand what you mean, but give me a chance to understand you. Watch me, and if I fail to do your bidding see if something is not wrong with my harness or my feet. Examine my teeth when I do not eat, I may have an ulcerated tooth, and that you know is very painful. Do not tie my head in an unnatural position, or take away my best defence against flies or mosquitos by cutting off my tail. And finally, oh, my master, when my youthful strength is gone do not turn me out to starve or freeze, or sell me to some cruel owner to be slowly tortured and starved to death. But do thou, my master, if adversity do come, take my life in the kindest way, and your God will reward you here and hereafter.

AN INVESTIGATION INTO THE BRAXY-LIKE DISEASE IN W.A.

H. W. Bennetts, M.V.Sc.
Veterinary Pathologist.

The term "Braxy-like" was applied by Prof. Dakin to an affection in sheep which was at one time referred to as the Beverley Disease. Even if this were justified ten years ago, which seems doubtful, the present distribution of the disease makes the latter designation unjustifiable. The term Braxy-like has long since been applied to similar diseases in the Eastern States and Tasmania, and may be quite correctly given to the local condition.

1. *History.*—Before dealing with the present investigation it were well to briefly review the position with regard to this condition prior to 1925. The first official record of sheep mortality, ascribed to this cause, was in the year 1915, though some consider the condition to have been existent years before. However, no serious trouble from this cause appears to have been evident until 1915-1916. The trouble apparently originated in part of the districts surrounding the Great Southern Railway, and most of the losses sustained during past years have been in these districts.

The losses experienced were put down to parasitic infestation, feeding irregularities, etc., and no systematic investigation was made until the year 1918, when Prof. Dakin of the University of Western Australia, undertook the work. He correctly defined the condition as being a toxaemia (poisons circulating in the blood stream), but was unable to arrive at the cause, his first conclusions being that the disease was probably not of bacterial or parasitic origin. He recognised its similarity to the so-called Braxy-like diseases in New South Wales, Victoria and Tasmania, and thought the causes might be similar. Feeding conditions were considered to have a bearing on the mortality. He later proceeded to Europe to study Braxy as it occurs in Ireland and Scotland, and to discuss with the Danish authorities the similar conditions in Iceland. A report was furnished in 1921 in which he reviews the position in W.A. and traces the similarity of the W.A. disease to Braxy in these places. He considers the W.A. conditions as being Braxy, but not caused, probably, by the same germ as is responsible in the countries referred to. (Since his visit considerable advances have been made, particularly in Scotland, in the study of Braxy, and the casual germ definitely established.)

The present investigation.—The investigation into the cause of sheep mortality in W.A. is by no means complete, and the purpose of this article is to demonstrate to those interested that something is being done; to define the condition in popular form, so that it may be recognised by those as yet unacquainted with it and so that more information may become available; also to emphasise the importance of the co-operation of sheep owners, without which little can be achieved.

I commenced duty here as Veterinary Pathologist on May the 14th, at the beginning of the season, and though it was impossible that a new laboratory be got into working order for a few months, in view of the urgency of the problem it was decided that a preliminary investigation be undertaken

almost immediately. The purpose of this was to determine the cause of the condition. Under the circumstances, it was only possible, with this end in view, to work along two lines. (1) To collect as much information as possible by visits to affected districts and by means of circularisation of farmers. (2) To conduct post-mortem examinations on as many sheep as possible killed while sick, or examined at the point of death, in an endeavour to find constant changes in the carcase; also to make microscopic preparations of the different organs to determine what changes take place, and, possibly, to find the casual agent.

Accordingly at the beginning of June a short visit was paid to Northam, Burgess Siding, York, and Beverley. The outcome of this visit was the determination to institute a temporary branch laboratory at Beverley at the earliest possible date, making it a centre for investigational work, and to circularise sheep owners through the roads boards of districts where the disease was known to be prevalent. These circulars were distributed as two typewritten forms, one setting out pertinent questions with space for answers, the other, Form "B" set out under the following heads:—

BRAXY-LIKE DISEASE AFFECTING SHEEP IN THE AVON VALLEY.

FORM "B."

Season 1925.

1. What was the date of the first death from this disease this season ?..............................

2. As far as possible a record should be kept this season, in accordance with the following table :—

Date.	Number of Sheep dead.	Age.	Sex.	Breed.	Condition.	Climatic conditions, Dew, Rain, etc.	Type of Pasture.

The response to this latter has been extremely disappointing, and as information thus supplied is likely to be extremely valuable I would like to urge the importance of this matter being attended to next season.

The laboratory was instituted in Beverley at the beginning of July, and used as a headquarters during the remainder of the season, my time being almost entirely given up to this problem.

During this season the following places have been visited in order to obtain information, conduct post-mortem examinations, and determine the general conditions obtaining: Spencer's Brook, Gwambygine, Brookton, Pingelly, Narrogin, Rossmore, Goomalling.

Dakin records the trouble in the following districts (1918): Beverley, Brookton, Pingelly, Mt. Kokeby, York, Spencer's Brook, Northam, Dowerin, Popanyinning, Wandering, Williams, Greenhills, Dangin, Cuballing. With the exception of Goomalling I have received authentic reports from no other districts, but indications are that the disease is much more widely spread.

It is most important to know, as far as possible, the exact distribution of the trouble, in order to determine whether any local conditions, at any rate, predispose to the trouble. In the interests of the State it is hoped that sheep owners experiencing sheep mortality under conditions described hereunder, will report same to the Stock Department.

The whole history of the problem bristles with inconsistencies, and views of to-day have to be modified to-morrow. The following appear to be facts:—

(a) The disease is seasonal, deaths occurring from June (earlier with early rains) till the end of October or November.

(b) Apparent illness of very short duration. The sheep are, as a rule, just found dead without any signs of struggle.

(c) Only sheep in good condition are affected.

(d) Sheep dead from the disease putrefy (blow up) very quickly.

(e) Deaths only rarely occur on uncultivated land and cease if sheep are removed from cultivated land, where they are dying, on to bush country.

Mortality commences after the first rains, when feed becomes good, and continues right through the winter months, and often seems to be greater towards the end of the season, when many lambs are lost. The percentage of deaths experienced in a flock may, exceptionally, reach 30 per cent.; individual losses of 5 per cent. for the season are quite common.

Deaths occur at irregular intervals, usually in twos and threes, but sometimes in a large flock as many as a dozen or more may be found dead one morning. Mortality may start at any time during the season, and then stop, as suddenly as it started, without any apparent reason.

Some paddocks appear to be dangerous whilst there are others adjacent to these where deaths have never occurred, though no apparent differences can be detected. Even some farms may remain immune from these extraordinary visitations though all the neighbouring ones have been losing more or less intensely for years.

A farmer may lose heavily one year and escape the next. There seems to be no set of circumstances which can be definitely implicated as giving rise to this condition. The sheep are most often found dead in the morning, and certain conditions appear to favour the trouble, as luxuriant green feed, and light rains, or heavy dew; but sheep will die at any time during the season (May-November), and under any circumstances. In this regard it has been the history in the past that luxuriant rank feed had an important bearing on the mortality and that death occurred most frequently after rain. The present year has been exceptionally dry and the feed generally very short, despite which the mortality this year has been very severe. Losses have been fairly general in the Goomalling district for the first time this year—up to 10 per cent. in some cases. On one place here, where I confirmed the diagnosis by a post-mortem examination on a lamb killed while sick, the feed on the paddock where deaths were occurring was exceedingly poor and there had been little rain for some time.

There is no evidence of the disease being of a contagious character; evidence points rather to mortality being due to circumstances arising after a place has been stocked for some years. Sheep of all ages, from young

lambs to full mouths, may be affected. It has been held by many that young sheep are most frequently affected, but I am doubtful of that being the case. The question of sex and breed seems to have little bearing on the mortality.

Symptoms.—The period between the onset of symptoms and death is very short, and usually the sheep are simply found dead. I have seen a good many sick ones, and they usually show a partial paralysis of limbs, giving rise to a staggering gait, and sometimes knuckling over. There are also signs of nervous excitement (chewing objects, etc.). They soon fall down, lie on the side, often with head turned back on one side. They attempt to rise, and may even do so and walk to another spot. They are at first affected with convulsions from time to time, especially if excited. Frothing at the nose or mouth and grinding of teeth are common symptoms. The temperature is usually normal but breathing often hurried or laboured. Nearly all the affected sheep I have seen have shown signs of scouring, and scoured droppings on the sheep camp is often said to herald the approach of the trouble. Very soon the sheep becomes unconscious, lies stretched out on its side oblivious of any surroundings, and dies. They rarely linger for more than a day; usually only a few hours after showing symptoms. Very often some, or almost all, of the symptoms described may be absent.

After death sheep blow up rapidly, the wool tears out and skin becomes discoloured, and putrefaction is advanced shortly after death.

Post-mortem Findings.—In all, about twenty affected sheep which had just died, or were killed while sick, have been examined, and constant changes found in all cases. Microscopic examinations of organs have revealed the same changes also in all. Parasitic worms are conspicuous rather by their absence than their presence. The first stomach is usually fairly full and normal, though sometimes the contents appear gassy. The fourth stomach and bowels are as a rule fairly empty, the bowels being more or less distended with gas. The bowels always show patches of congestion (pinkish-red colour), outside and inside, through almost their entire length. The gall bladder is usually distended with bile. The lungs are often congested from the mechanical effects of lying down.

These are the more striking changes to the laymen, but the typical and constant changes are slight and easily passed over by the untrained eye. The kidneys, when cut across, are found to be always congested, and microscopical examination reveals inflammation. The liver is slightly softer than normal. Microscopic examination reveals degeneration (always). There are usually small blood spots (petechiae) on the outside of the heart, and large ones (Ecchymoses) on the inside of the heart wall. The changes are those of toxaemia, *i.e.*, there is a poison circulating in the blood and producing changes in many of the organs, especially kidneys, liver, and heart. The starting point appears to be the stomach or bowels; but here lies the difficulty. I have been unable to find any part of the body of which one can definitely say, "Here is the beginning of the trouble; the cause is here."

Even an hour after death, owing to the rapidity of putrefaction, the carcass appears obviously diseased, and is incidentally useless for investigation purposes.

Cause.—With regard to the cause, let it be realised, as most of us realise, that the problem is difficult of solution, and will probably need a

protracted investigation even with all facilites. There are many theories at present held by farmers, none of which are satisfactory.

(a) Sand. It is impossible to consider this as any explanation, for the following reasons: Though sometimes the fourth stomach, or bowels may contain a fair amount of sand, it is always, in my experience, loose, and not causing any blockage, and most often there is only a negligible quantity present. Were this the cause, one would expect the mortality to be greater and infinitely more widely spread. More important still, the changes found in the body are such that could never be produced by this cause.

(b) Superphosphate is argued by many to be the cause, yet superphosphate licks can be given to animals with often very beneficial effects. Sheep will die on bush country where superphosphate has never been used and will not die on many paddocks top-dressed with superphosphate. Also, losses, were this the primary cause, would be universal.

(c) Poison plants. Various plants have been blamed, but it is impossible to sheet death home to any one species of plant, as the mortality occurs under such varied conditions. At least two botanical surveys have been made and nothing suspicious found (Stoward and Herbert).

(d) Soil conditions. Conditions of the soil, notably lime deficiency, have been considered as possible causes. There appears, at any rate, to be no question of lime deficiency in the soil of many of the affected districts, and it would be interesting to see whether top-dressing with lime would have any influence on mortality.

(e) Bacterial. The strongest evidence of the diseases being of bacterial origin is that almost all the picture agrees with the conditions of braxy in Scotland and Iceland, both of which have been definitely proved to be due to the same bacterial cause, also to similar diseases which have been investigated at different times in Tasmania, Victoria and New South Wales, these also being ascribed to bacterial causes.

Both Braxy and Braxy-like conditions found in Australia are seasonal, the circumstances of death are the same, *i.e.*, sheep in good condition affected, sudden death, rapid putrefaction, and death distributed in twos and threes; and the post-mortem appearances are very much alike. The post-mortem appearances are alike, but there are essential differences. Braxy is a disease with a definite inflammation, sometimes necrosis (death) of the lining of the fourth stomach, due to bacterial invasion. The Braxy-like diseases in Victoria and New South Wales are considered to be of bacterial origin. In this case the stomach lesion is absent, but there are necrotre (dead) areas in the liver where the casual organism is found. In our local conditions neither of these primary changes are found—the only essential point of dissimilarity.

Towards the end of the season preparations were sufficiently advanced to permit of a bacteriological examination of diseased sheep being made. Unfortunately it was then only possible to obtain a few subjects, and it is hoped to continue along these lines next season.

Recommendations. It has not been possible, up to the present, to materially add to measures which have already been suggested, some of which appear to have been valuable in certain cases upon the appearance of trouble.

(a) Moving sheep to bush country, or, if this be impossible, shifting them to different paddocks every few days.

(b) Always burn dead sheep.

(c) Feeding of dry feed (chaff) in automatic feeders, throughout the season, adequate provision being made for feeding.

(d) Licks should prove valuable. The following formula has been recommended: salt, 40 parts; lime, 10 parts; iron sulphate, 4 parts.

(N.B.—The practice of several farmers of yarding sheep or putting them on to bare paddocks every night appears to stop mortality, but appears impracticable and otherwise objectionable in most instances.)

Lines for future work.—It is hoped that next year early opportunity will be given for the continuation of the investigation. It is intended to carry out extensive bacteriological tests, and also to test on a scientific basis the possible value of Braxy vaccine, which has proved so valuable in reducing the mortality, during the last four years, from Braxy in Scotland. The results of a limited experiment with the same vaccine, this year, were rather suggestive.

In conclusion, the thanks of the Department are due to the valuable assistance rendered by the Beverley Road Board, and to many of the sheep owners in affected districts, for their co-operation.

SPECIFIC HEAT.

The quantity of heat, termed specific heat, required to raise the temperature of one pound weight of water one degree of temperature is taken as a unit. Any substance requiring more or less heat than an equal quantity of water requires to raise its temperature one degree is said to be of higher or lower specific heat. Mercury requires only 1/30th the quantity of heat that water does, and its specific heat is expressed as .033; hydrogen requires nearly three and a-half times as much as water, its specific heat being 3.405.

ADVANTAGES OF TIMBER.

Timber is stronger than is generally supposed. In tensile strength (resistance to a pull lengthwise of the grain) a bar of certain woods exceeds a similar bar of iron or steel of the same weight and height. A selected piece of yate timber resisted a stress of 19½ tons to the square inch. Timber can stand a far greater distortion than metal without losing its power to regain is original position. In this way timber gives a warning before reaching breaking point.

WHEAT EXPERIMENT PLOTS AT KALGOORLIE.

GEO. L. SUTTON, Director of Agriculture.

The establishment of an Experiment Farm at Kalgoorlie was suggested by the Hon. H. Seddon, M.L.C., in July, 1922, and in March of the following year a request in the same connection was submitted by the Kalgoorlie Municipal Council. Though unable to accede to the request to establish an Experiment Farm, the Hon. Minister for Agriculture decided to approve of experiments being carried out with the co-operation of the Council on somewhat similar lines to those on which farmers' trials were conducted. The Council willingly undertook to co-operate and to provide the land and labour necessary for the operations: the Department undertaking to provide the seed and fertilisers required, and to detail an officer to plan the experiments and supervise them.

The Council entered whole-heartedly into the project, and early in May, 1923, made available for the experiments some 36 acres adjoining their sanitary depôt. The land in this area was the rich red clay loam typical of the Goldfields country, and on which previously there had been growing Salmon Gum trees (*Eucalyptus salmonophloia*) and scrub. The operations were placed in charge of their Mr. F. W. Cox, who took it up with vigour and enthusiasm. About 12 acres of land intended for the next year's planting were ploughed immediately about four inches deep, and subsequently cultivated as required to bring it to a suitable tilth and to conserve moisture.

No pains were spared to bring the fallowed land into good condition. The planting and supervision of the experiments were placed under the control of Mr. H. Rudall, Field Officer, who arranged that plots of the varieties "Nabawa," "Gluyas Early," Merredin," and "Florence" should be planted in duplicate. The seeding was commenced on April 24th and completed on 30th idem. The seed was sown at the rate of 45lbs. per acre, and the fertiliser —superphosphate 22 per cent.—applied at the rate of 70lbs. per acre. The seed bed at this time was in splendid order, but dry, and in consequence the seed did not germinate until about the third week in May following upon 29, 13, and 14 points of rain, which fell respectively upon the 12th, 14th, and 15th of that month. The seed germinated regularly and well, and for some time continued to grow satisfactorily. Unfortunately, however, the rainfall subsequent to the germination was extremely scanty, the individual falls being as hereunder:—

May	25th	8 points	
	31st	3 ,,	
			11 points.
June	3rd	6 points	
	7th	3 ,,	
	8th	5 ,,	
	12th	1 ,,	
			15 points.
July	12th	4 points	
	22nd	16 ,,	
	25th	2 ,,	
	26th	9 ,,	
			31 points.
Aug.	8th	21 points	
	11th	3 ,,	
	12th	1 ,,	
	16th	1 ,,	
	17th	1 ,,	
	20th	2 ,,	
	31st	3 ,,	
			32 points.
		Total ...	89 points.

Towards the end of July it was evident that the absence of useful rain since the seeds germinated was telling so severely against the crop that it must succumb, and on 28th August Mr. Cox wrote as follows:—

> "I am sorry to inform you that owing to the lack of rain the experiment for this season has been a complete failure. The seed germinated fairly well after 66 points of rain, and grew strongly to three or four inches in height, but after that—with the exception of a few odd patches which still survive, but only a few inches high—gradually died off. This is not to be wondered at, considering that we have only had 146 points of rain from the time of sowing until the present date. It is the driest season known to the Goldfields."

Despite this failure the Municipal Council, with very commendable public spirit, decided to continue the work for at least three years, as originally arranged.

The ground for the 1925 crop was prepared by ploughing after the useful rains in September, which commenced on the 9th and 10th of that month, when 72 points were recorded. Subsequent to the ploughing and prior to seeding, the ploughed land was cultivated four times, the aim being to conserve the moisture by cultivating after a fall of 25 points of rain.

As in the previous year, the seed bed was in excellent condition. Seed was sown from 17th to 21st April. At this time the ground was quite moist a few inches below the surface, consequent upon the conservation of the rainfall subsequent to the initial ploughing.

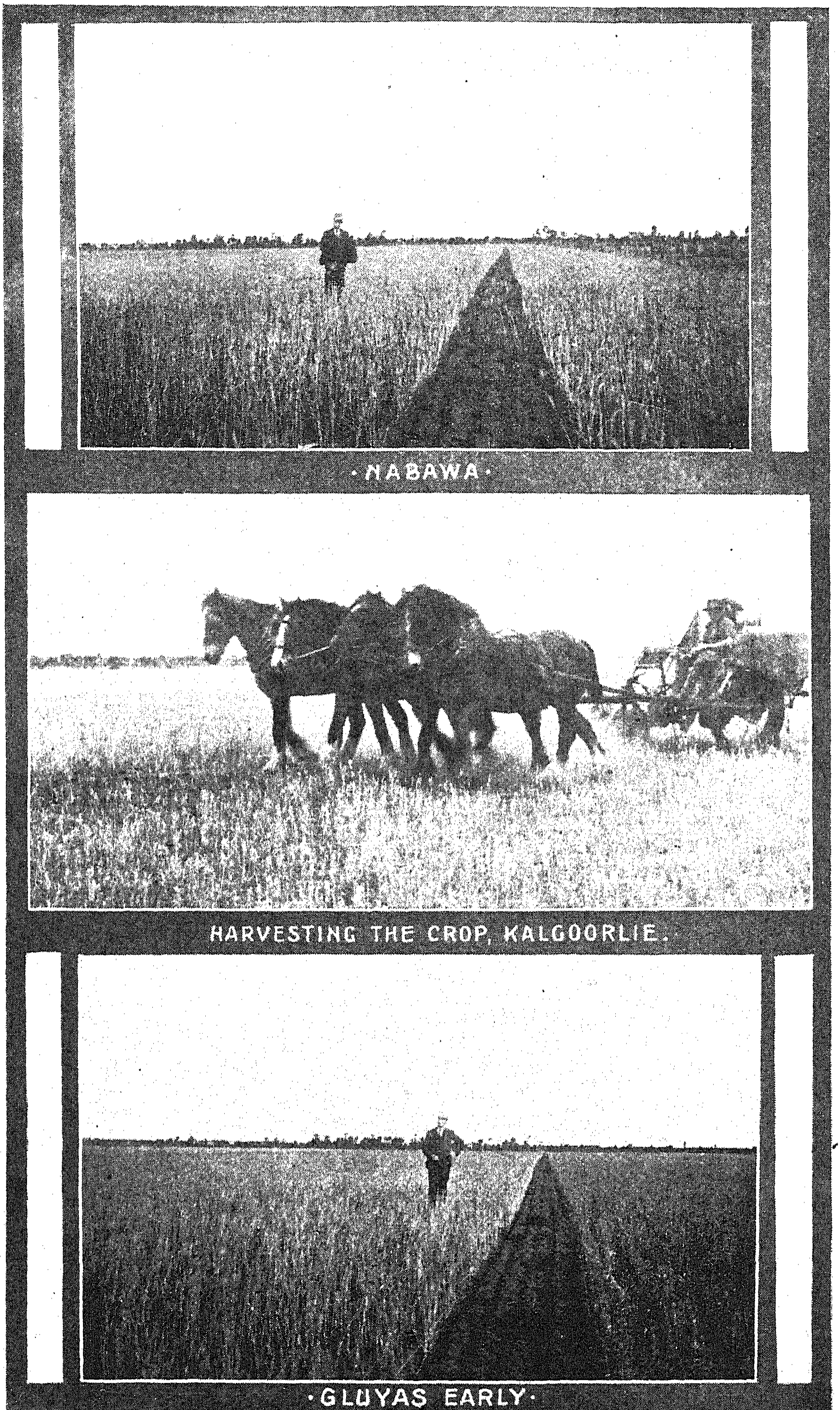
The varieties of wheat planted were "Nabawa," "Gluyas Early," "Merredin," and "Florence." In addition to these the following varieties of oats were planted, viz., "Lachlan," "Guyra," "Burt's Early," and "Mulga."

With the object of facilitating the harvesting of the wheat plots, the oat plots were alternated with the wheat as shown on the sketch hereunder:—

HEADLAND.
Nabawa.
Lachlan Oats
Gluyas Early
Guyra Oats
Merredin
Burt's Early Oats
Florance
Mulga Oats
HEADLAND

Each plot was 135 links wide and 10 chains long, and was thus slightly over $1\frac{1}{3}$ acres in area.

The rate of seeding was: wheat 45lbs. and oats 40lbs. per acre. The fertiliser used was: superphosphate (22 per cent.) at the rate of 75lbs. per acre.



Trial Wheat Plots, Kalgoorlie, 1925.

Eight days after planting there was an excellent fall of rain which, with that recorded on the succeeding day, totalled 139 points, and this resulted in a good and regular germination of both wheat and oats. Unfortunately, these two falls on the 29th and 30th of April were the heaviest recorded during the growing period, the next heaviest being 37 points on the 10th September, when the crop was so mature that it received little, if any, benefit from it.

The detailed rainfall recorded after the first useful rain for fallowing in September, 1924, until the crop matured, is as hereunder:—

Prior to Planting, 1924.

September	9th	14	
,,	10th	58	
,,	19th	29	
,,	26th	16	
			117
October	5th	5	
,,	18th	8	
,,	19th	49	
,,	27th	8	
			70
November	...	*nil*	
			Nil
December	12th	1	
			1
January	4th	13	
,,	14th	2	
,,	24th	16	
,,	25th	1	
			32
February	16th	68	
,,	17th	47	
,,	18th	1	
,,	23rd	9	
,,	26th	1	
,,	27th	107	
,,	28th	111	
			344
March	1st	23	
,,	3rd	1	
,,	4th	8	
,,	7th	15	
,,	9th	5	
,,	15th	5	
,,	16th	6	
,,	24th	41	
,,	28th	5	
			109
April	1st	10	
,,	10th	2	
			12
			685

After Planting, 1925.

April	29th	121	
,,	30th	18	
			139
May	1st	5	
,,	3rd	1	
,,	20th	33	
,,	21st	5	
,,	28th	6	
			50
June	15th	4	
,,	22nd	1	
,,	28th	3	
,,	29th	4	
,,	30th	31	
			43
July	9th	22	
,,	10th	2	
,,	15th	4	
,,	18th	3	
,,	24th	1	
,,	25th	11	
,,	28th	6	
			49
August	7th	4	
,,	17th	2	
,,	28th	6	
			12
Sept.	10th	37	
,,	11th	11	
,,	13th	8	
			56
			349

It will thus be seen that the rain recorded during the growing period was 349 points, but unfortunately, with the exception of the initial rains, most of the falls were light and not of a useful character.

The appearance of the plots when ripe may be judged from the illustration herewith, and though it was recognised that the crops were not a commercial success, it was decided to harvest them in order to ascertain the actual yield produced under such adverse circumstances. The crops were accordingly harvested with the stripper-harvester by Mr. J. H. Langfield, Manager of the Merredin Experiment Farm, who journeyed to Kalgoorlie specially for this work. The acre yields obtained were:—

	bushels.	lbs.
"Gluyas Early"	5	17
"Nabawa"	5	0
"Florence"	3	15
"Merredin"	1	54

The quality of the grain produced by the different varieties, especially by "Florence," was particularly good. The brightness of grain even surpasses that usually produced in the Eastern wheat area.

The results obtained under such circumstances show "Gluyas Early" and "Nabawa" to be excellent drought resisters. It is surprising that a mid-season variety like "Nabawa" has made such a good showing, and an early variety like "Merredin" such a poor one.

Though the trial cannot be regarded as a commercial success, the results obtained are better than some obtained with inferior methods in more favoured districts. They are very useful in that they show how valuable good methods can be under dry conditions, and lessen the fear of a complete failure in the main wheat belt even in a year of unexceptional severity.

The rainfall for 1925 to date amounts to 1,164 points, which, taken as a whole, would be regarded as sufficient to produce a payable wheat crop. The results obtained this year at Kalgoorlie show how unreliable a guide in this purpose is the total. Even with the seed bed in the best of tilth, and with a subsoil quite moist to start with, it is very evident that more importance must be attached to the quantity, the sequence, and the character of the rainfall during the growing period, than to the aggregate quantity recorded during the year, or even during the growing period.

The oats were so short that it was decided not to harvest them, but to leave them to be grazed by the municipal horses. "Guyra" was regarded as having done the best with an estimated yield of eight bushels.

SIMPLE RULES OF MENSURATION.

The area of a circle is about three-fourths the area of a square having a side equal to its diameter.

The circumference of a circle is about three and one-seventh times its diameter.

The length, breadth and height, in feet, of a cistern multiplied together, and the product multiplied by six and a-quarter, will give the capacity in gallons.

THE WOOL CLIP.

H. McCallum,
Sheep and Wool Inspector.

PREPARE THE WOOL CLIP CAREFULLY.

Many wool growers have realised that the more skilfully the clip is prepared for market, the greater will be their profit. Often a good wool clip is marred by careless handling, and it is surprising the number of such badly classed clips that can be seen on visiting the Fremantle wool stores.

It must be remembered that no matter how superior the quality of the wool may be, if proper attention is not given to skirting, classing, and packing, comparatively poor prices have to be accepted. The grower very often thinks his wool has been sacrificed by the broker. This is not so, the brokers have done all possible to show the clip to the best advantage, and the cause of the low price is solely bad classing.

A well got up clip, whether large or small, finds a ready sale, but a clip carelessly prepared is difficult to dispose of. The former sells well, even on a falling market, whilst the latter seldom, if ever, realises full value. The time and labour bestowed on the preparing of the wool clip for sale are well expended, and bring their own reward.

METHOD OF SELLING THE CLIP.

Production is advancing rapidly in Western Australia: immense areas of new country have been taken up and stocked with sheep; some station owners are replacing cattle with sheep and turning their attention to wool growing with satisfactory results. Many pastoralists in the settled north, by a lavish outlay of capital are making their country carry many more sheep than they were able to pasture with safety a few years ago, and wheat growers, where possible, are now adopting the safe course of sheep raising with agriculture.

Both large and small clips will annually increase in numbers and, as our local market at the same time is gaining in importance and popularity with the growers, the catalogues—as a natural consequence—will become larger every year, thus making it impossible for the buyers to give as much time as they would like to each individual lot.

The wool valuer's task can easily be imagined; it has to be carried out in a limited time, therefore, it is absolutely essential that there should be nothing to obstruct the buyer. This is well known to the selling brokers, who, desirous that each lot shall receive a full share of attention, offer every facility for examination, and do all in their power to expedite the valuer's progress, even to re-classing badly "got up" clips.

The clips for sale are carefully divided according to their qualities, separate lots being made of fleeces, necks, pieces, bellies, locks, lambs, etc. The sample bales of the various lots are opened out, thereby displaying the contents for inspection, whilst carefully prepared catalogues, giving particulars of brands, number of bales, and description, are ready to hand.

But all the brokers can do, on behalf of the wool grower, will not compensate for careless classing. The fault lies with the grower, who has not done the work satisfactorily, and he it is who must remedy it. Well classed clips are eagerly sought after, and will command keen competition.

In Western Australia every wool grower has the opportunity of visiting the wool stores at Fremantle during that period of bustling activity known as the "wool season." Many hundreds of growers during the year take advantage of this opportunity of comparing their wool with other lots, and of studying the manner in which the various clips are classed. This is a good education, and much knowledge can be gained from talks with the wool experts, who are always ready to inspect and discuss the clips. These visits enable many growers to define the classes to which their wool rightly belongs, and they can fix the relation between the "get up" of the clip and price. The small wool producer, who has not yet availed himself of this chance of seeing the clips on the show floor of the wool warehouses, should do so as early as possible.

The immense stores, which are designed for the display of wool to the best advantage, are admirably lighted from the sides and roof, on the newest and most approved principal. All round are the sample bales of the various clips to be offered for sale, both large and small. They are placed in rows, with ample passage-way between each row. Busily engaged in valuing are the buyers from the chief manufacturing centres of the world. Some give their attention to the larger clips, others devote most of their time to the small lots, whilst many inspect and value each separate lot shown on the floor. Particular lots appear to receive their full share of attention, and there is no doubt but that they will be keenly competed for. Why? The contents are suitable for the buyer's requirements, each bale is of good average quality, and the classing has been carefully done. Other lots, perhaps, on examination prove to be unclassed and unskirted, and many fleeces contain foreign matter. There is not much fault to find with the quality of the wool, but owing to lack of proper classing its market value has depreciated, and it will be disposed of at a much lower price per pound than if it had received careful attention. Why some wool growers continue to neglect the preparation of their clips for market is hard to understand.

When marketing wool the broker should not be hampered with excessive reserves. The experts attached to the wool warehouse know the value of the wool and the state of the markets, present and prospective, better than the grower. Moreover, it is in the broker's interest to realise as high a price as possible for the clip.

VARIETIES OF WOOL.

It is chiefly due to the great variety of wools submitted at Fremantle that so many buyers from overseas visit this State.

Here again is another reason why the grower should visit the wool warehouses. He can thus familarise himself with the different types of wool produced in various localities, and then select the sheep best suited to his own district. A glance will show that temperature and district in this vast State have a tendency to produce distinct types of wool, and it is essential that a grower selects the type of breed suited to the district in which his holding is situated, that is if he intends making a commercial success of his under-

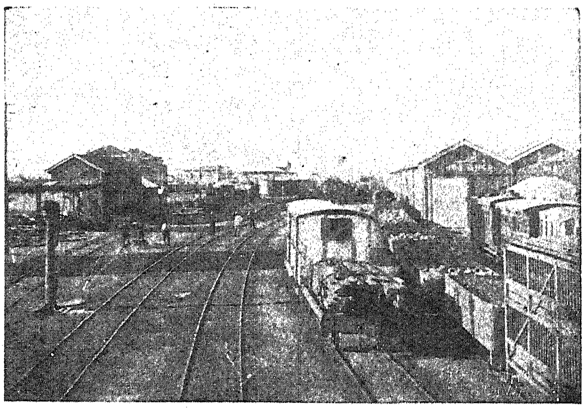
taking. On the show floor every class used in the manufacture of fabrics can be seen. Here will be found varieties sufficient to suit all climates and requirements, from the far north Kimberley to the southern coast.

ATTENTION TO BREEDING.

The production of wool has, from the earliest periods, been a source of great wealth to those countries where the industry has been fostered. As an article of commerce it is second to none; as a trade commodity its buoyancy and vigour are unsurpassed.

In no place has the development of this industry been more rapid than in Western Australia. Great progress has been made in the past, but the future promises to far outstrip this, and, with such a possibility before them, it behoves all sheep breeders to raise the whole of their wool to the high standard of excellence that some of our best wool has attained. With intelligent management, care, and judicious selection, there is nothing to prevent the bulk of our production being so improved.

Our climate and pastures are favourable to the growth of good wool—well bred sheep mean good wool—inferior animals—wool of little commercial value. Therefore, to increase the poundage per head, only stock that possess some distinct points of excellence must be bred from, and all mongrel and poorly-woolled animals culled out.



HORTICULTURAL NOTES.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

SEASONAL WORK FOR JANUARY, FEBRUARY, AND MARCH.

January.

In orchards devoted to the production of mixed deciduous fruits, the principal occupation during this month is the gathering and marketing of stone fruit—apricots, peaches, plums, etc.—and care and judgment must be exercised by those who are many miles distant from market in picking and packing the fruit so that, while it has attained a sufficient stage of ripeness to be sweet and juicy, it is still sufficiently firm to stand a long rail journey without opening up in "jam" condition.

If summer rains occur, cultivators must be used as soon as practicable afterwards to conserve the moisture in the soil.

Fruit fly needs constant attention in the infested areas, and no infested fruit should be allowed to remain on the ground, but should be picked up daily and destroyed by boiling. Fruit fly bait should be freely used, and every care taken that no infested fruits are offered for sale.

Apple and pear growers should keep Codlin Moth in mind, remembering that it is once more present in one orchard in the State, and notify this Department at once if anything suspicious is seen to be affecting the fruits named. If this is done and outbreaks which may occur can be dealt with in the initial stages, the pest can be subdued, and the State kept free of the scourge which a general infestation of the orchards would mean.

Red Mite continues to effect a deal of damage, particularly in the apple orchards each year, and where it is present the trees should be sprayed this month with atomic sulphur, using 1lb. in 10 gallons of water.

This is the third consecutive season in which the majority of the citrus orchards in the State have been remarkably free from Red Scale, owing to the excellent work done by the parasite, *Aphelinus diaspidis*. This beneficial insect has now been so widely distributed by the departmental officers that there is no important citrus growing centre where it has not been liberated with the result mentioned above, and present appearances promise that very little spraying or fumigation will be necessary in the coming season to control Red Scale. Where the pest is not being kept under control, spraying or fumigation should be carried out this month.

February.

Gathering and marketing of stone fruits will still be in full swing during this month, and early varieties of pears and apples will also claim attention. The very early pears, such as Citron des Carmes and Jargonelle, are allowed to ripen on the trees, and are fit to gather in December and January, but these are poor in quality, and are not recommended for commercial orchards. Practically all the best pears must be gathered before ripening, and allowed to mellow in storage before they attain the peak condition

of flavour and texture. In a less degree this applies also to apples, but there are some good varieties of the latter fruit which are excellent for dessert purposes when freshly pulled from the trees; Gravenstein and Jonathan being two good examples.

The ease with which the stem of the fruit separates from the spur to which it is attached is a good guide as to the fitness of the fruit for gathering.

This month usually sees the first shipment of apples to England, but it is hoped that growers will refrain from exporting immature fruit this season, and put off export until about the end of the first week in March. This applies particularly to Jonathans, which should not be gathered until they have attained a good rich red colour. The early ripening specimens generally are borne on terminal buds; they are soft and spongy, lacking in colour and quality, and very apt to develop bitter pit and Jonathan Spot on the voyage. They open up so badly on arrival in England that they spoil the sale of later consignments of the same variety, which, when of 2¼in. to 2½in. in size and gathered at the right time, is one of the best export apples grown. If an early picking must be effected, then Cleopatra is much safer to gather on the green side than Jonathan, but, as stated, the advice is to entirely refrain from exporting immature apples.

Advice *re* Fruit Fly and Codlin Moth, published in notes for last month, apply with equal force during February.

March.

Apple growers will be very busy this month gathering and packing fruit for export, and every care should be exercised so that the good name for quality and appearance which "the apples in the red boxes" have obtained in the London and European markets may be fully sustained. Grade carefully, reject severely, pack honestly, stencil neatly and correctly, and prices will prove remunerative.

This advice applies whether the product exported comprises apples, pears, grapes, or oranges, but the payable price is not so certain with the other kinds as it is with apples; the other fruits being tenderer and more subject to damage during transit.

Continue the war against Fruit Fly, and by watchfulness and immediate action when necessary prevent Codlin Moth from making its home in the West.

THE RED LEGGED EARTH MITE.

Penthaleus destructor (Jack).

L. J. Newman, F.E.S.,
Entomologist.

This mite now constitutes one of the worst of our winter pests. It was first recorded from the Bunbury district in the winter and spring of 1917. Complaints were received that red spider was destroying the potatoes and other vegetable crops. An investigation was made, and it was found that the causative factor was not the red spider, which only appears in damaging numbers in the dry weather, but was a new species of plant eating mite, now known as the Red Legged Earth Mite. The mite was found infesting many different kinds of plants, being particularly damaging to young seedlings and tender foilage.

From this initial outbreak the pest has now become well established throughout the light lands of the South-West and Great Southern, and has penetrated in a lesser degree into the wheat areas.

In spite of repeated warnings not to trade in infested seedlings or cuttings, this was done, with the result that within a very short time outbreaks were reported from widely separated districts.

This acarian or mite is a non-web spinning species, and belongs to the family known as the Eupodidae. Many of the members of this family are predaceous on insects, and therefore beneficial, but, unfortunately, the mite under discussion is wholly a plant feeder.

In continuance of our studies of the life history of this pest, it has been discovered that an error has been made in its generic determination and name. It is not of the Genus *Notophallus*, but belongs to the Genus *Penthaleus.* It is, therefore, proposed to let the common or vernacular name of Red Legged Earth Mite stand, but to adopt the generic and specific name of *Penthaleus destructor* (Jack).

In a recent bulletin issued by the South African Department of Agriculture, there appears a chapter by W. E. Jacker giving a key and general description of the mite known there as the Black Sand Mite.

A study of this key and a comparison of the mite found locally leaves no doubt that they are identical—*Penthaleus destructor.* South Africa and Western Australia appear to be the only countries from which this mite has been recorded. It is evidently a native of South Africa. How it came to be introduced into our State is not known, and probably never will be known. What we do know to our great cost is, that it has become well established within our borders, and will remain a permanent economic factor in the growth of winter crops, particularly in our moist sandy or light loam coastal lands.

Life History.—The pest makes its appearance about the first week in May, following the advent of the winter rains. It suddenly appears in swarms attacking seriously young seedlings which have come up as the result of the rains. So sudden is the attack that many growers conclude that the mite lives and breeds in the soil, and comes forth to attack the young growth as soon as it appears. Others are just as emphatic that it is brought in with

the manure. Both suppositions are entirely wrong. After careful study it has been proved that the mite does not descend into the soil, nor does it feed and breed in manure. There are many kinds of mites, and manure is often teeming with them. These, fortunately, are only scavenger mites, which feed upon decaying matter.

The Red Legged Mite will hide under clods of earth, surface manure, or other rubbish, but will not descend into the soil. The fact of the appearance of the pest in plague form, as soon as the wet season sets in, was evidence that large numbers must in some stage of existence carry through the dry summer months, November to April or May. This period is bridged over by the production towards the end of October of a resting egg. The setting in of dry and hot conditions is evidently the factor which induces the appearance of these hibernating eggs. Myriads are laid about the surface of the soil, under clods or dry weeds and rubbish. These eggs have a wonderful resistance to heat, drought, or desiccating winds. Moisture and mild sun heat are necessary for the hatching of these over-summering eggs. Even during winter, if we get a period of dry cold easterly winds, the winter eggs fail to hatch, and the adult insects die off in large numbers. The dryness of the month of August acted as a great check. If the carry-over was slight or more or less accidental, we should witness in May the ones and twos gradually working up to plague form towards the end of the season.

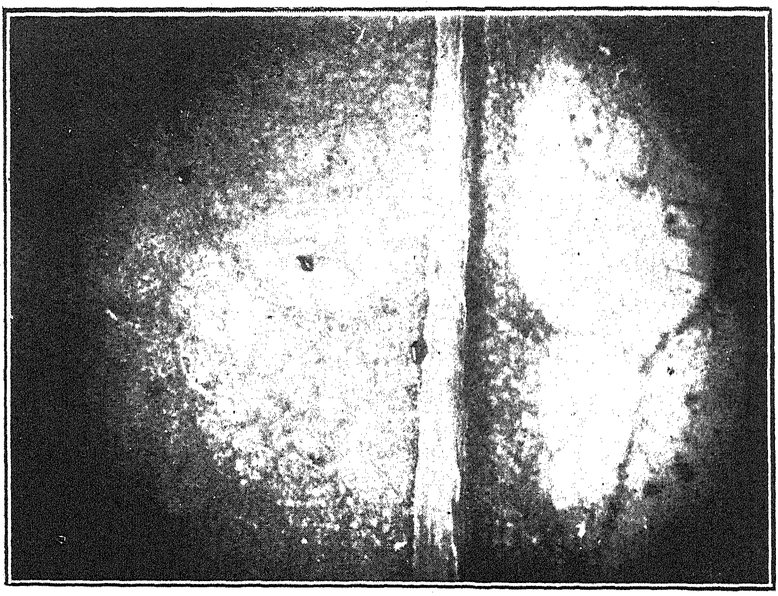


Fig. 1. (Original.)

Eggs of mite on leaf surface, greatly magnified.

The Eggs.—These are oval smooth bodies, reddish orange colour, attached to objects under clods or rubbish, or placed promiscuously on the backs or undersides of the leaves of the food plant, and can be only detected by the aid of a hand lens. These eggs hatch in from eight to 10 days in winter

or wet season, according to the moisture and humidity present in the atmosphere; dry winds or frosty weather delaying their development. After the hatching of the mite from the egg, the remaining shell appears white. As

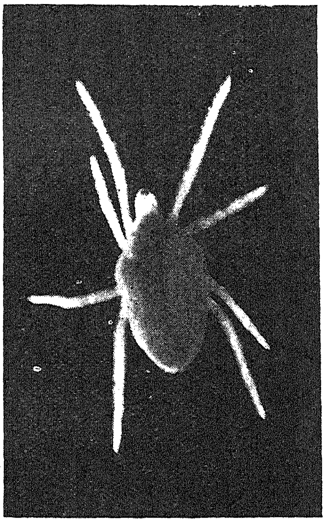


Fig. 2 (Original.)
Adult female, dorsal view, magnified by 20.

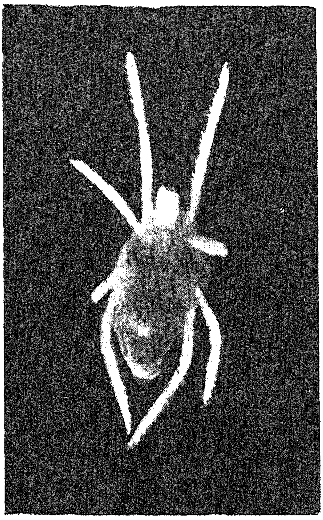


Fig. 3. (Original.)
Adult female, ventral view, magnified by 20.

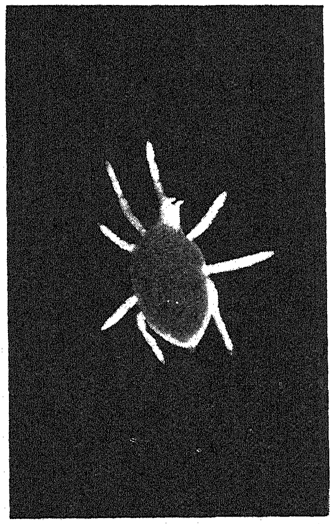


Fig. 4. (Original.)
Adult male, magnified by 20.

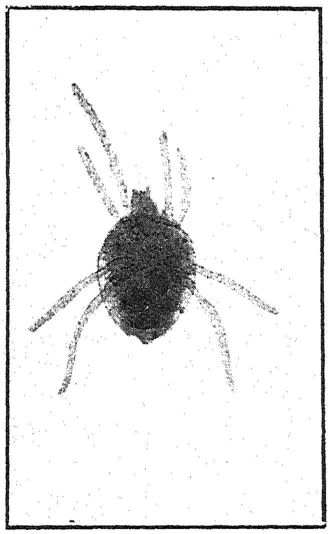


Fig. 5. (Original.)
Adult female, ventral view, showing eggs in body, magnified by 20.

the dry heat of summer approaches egg-laying increases, but hatching diminishes, until finally hatching ceases and the adults die, leaving the carry-over eggs.

The Larval Stage.—The newly-hatched mites are six-legged, bodies dull red, and legs pale. Within seven days of issuing they go through a moult, casting their skin and appearing with eight legs.

The Nymphal Stage.—During this period several moults take place, after the final the adult mite appears. This period occupies 25 to 30 days. 30 days.

Imago or Adult.—Size slightly under 1/25th of an inch, colour: mouth parts and legs bright red, body dense velvety blue-black; the whole being covered with fine hairs. The legs are moderately long, the front pair being the longest and apparently having a sensory function, as in the antennae of insects. The mite is soft-bodied, delicate, and easily damaged when handled. Their powers of locomotion are well developed, enabling them to move rapidly

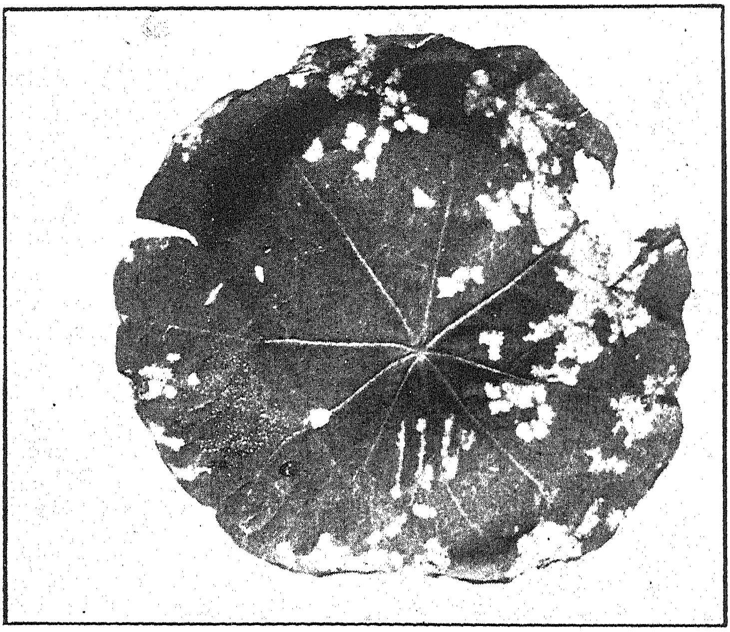


Fig. 6. (Original.)
Leaf of plant showing typical injury caused by mite.

over the surface of leaves, ground, etc. On a bright sunny morning in winter this rapid movement may be seen in the swarms of mites migrating from place to place, and thus they spread in all directions when once introduced.

The Mouth Parts.—These are formed for rasping rather than for piercing. The surface of the leaf is broken, and the sap sucked up. These attacked areas of the leaf show up as white or bleached patches, the whole of the green contents having been removed. When numerous, this process of bleaching is more than the young plants can stand, and naturally ends in their death. As the foliage becomes more advanced, the mites do not appear to be able to do much harm, no doubt the skins of the leaves become too tough for them to rasp through. The life of the adult is 30 to 35 days.

Food Plants.—The mite shows first and foremost a preference for the Cape Weed (*Cryptostemma calendalaceum*) and the common Chick Weed (*Stellaria media*). Other weeds are attacked to a lesser extent. In the garden most autumn and early winter seedlings are attacked. Amongst the crops peas, potatoes, lettuce, melons, pumpkins, lucerne, and subterranean clover are the most seriously attacked. The mite is, however, a most cosmopolitan feeder, but, as pointed out, it has certain preferences and increases more rapidly on some plants than others. When badly attacked the young plant simply slowly becomes discoloured, and finally withers up. It is a particularly serious pest when operating over large areas of field peas or clover paddocks. It checks the growth, and largely prevents the production of early winter feed. Later, should the plants survive the early attack, they grow ahead of the pest, and good late spring crops may be reaped.

Distribution.—The mite shows a decided partiality for sandy or light soils. It is certainly found on heavier soils, but does not swarm in countless numbers as on the lighter well-drained lands.

Climatic Influences.—These play a great part in the life of the mite. Moisture and humidity of atmosphere are the main controlling factors in the increase or decrease of this pest. Once the winds and ground become dry, the sun's rays strong, the shade temperature anything above 75 degrees, the mites rapidly die off. Normally, this is the condition of climate by the end of October, and thus few mites are to be found later, except in very favoured and cool moist locations. Mites are to be found in all parts of the world, but appear to be most numerous in temperate regions.

Parasites.—Although mites are perhaps not as abundant in species as insects, they make up for this by the enormous multiplication of individuals. They appear to have few enemies outside of their predatory relatives. Careful observation of the mite under discussion has failed to reveal any natural enemy of consequence. As a casual parasite, the Ladybird (*Rhizobius debelis*) has been observed to feed upon it.

Preventive Measures.—First and foremost, do not trade in seedlings or cuttings from infested gardens. This is one of the chief means of spreading the pest. The eggs are placed on the back of the leaves or on the twigs, and will hatch out in their new environment, and thus a fresh centre of infestation has been created. It is a good plan to always raise your plants from seed, for by so doing many a noxious insect is kept out.

Clean Cultivation.—The presence of weeds and rubbish is an ideal condition for the propagation of this pest. Keep land to be cropped well and deeply ploughed and weed free. Land that has been infested the previous season should be turned over deeply and rolled. By so doing the hibernating summer eggs will be too deeply buried for the mite to be able to reach the surface when it hatches in the autumn.

The mite being an annual winter pest can be easily starved out from any given area, by placing same under fallow for twelve months, allowing no plant growth whatever. Trap crops of peas can be sown with good effect. As soon as the mites have hatched out, and before egg-laying has taken place (which would not happen within 30 days of their hatching), the whole crop should be well ploughed under and rolled. Dip all seedling plants in a solution of tobacco water or kerosene emulsion before planting out. As the pest

thrives in damp and moist sheltered conditions, avoid same. Select, as far as possible, land that is on the heavy side, and use plenty of lime. Avoid the use of any top dressing or mulch, as this only gives harbor to the pest. Upon attempting to spray or dust they fall at once to the ground, and if mulching is present they rapidly crawl under same, and are secure from the treatment. All stable manure should, therefore, be dug in and the ground kept clean of any litter. In the late spring, when the weather conditions have killed off the mites, a summer mulch may be applied. All plants which lend themselves to trellising should be so grown, thus keeping them off the ground and more easily sprayed. The removal of the lower leaves of such plants as cabbage, lettuce, etc., reduces the shelter and renders the plant less liable to attack. Remove and destroy all useless plants. If possible keep a break of cleared land around crop. Raise your seedlings as early in the autumn as possible, thus having them strong and well grown before the mite appears.

It is not of much avail carrying out the before-mentioned preventive measures if, alongside, there exists dirty weedy infested headlands or banks. The mite will readily spread back from this source, and thus the previous good work will be largely nullified.

Treatment.—The great difficulty is that the pest is not confined to the plants we wish to protect, but is found swarming over the surrounding weeds from which they swarm back. Herein lies the virtue of clean cultivation and farm sanitation

With a view to overcoming this pest, the Entomological Branch has carried out a large series of experiments during the past winter. To reduce the cost of treatment an attempt was made to incorporate with a manure a mite-killing agent, and thus produce a combined miteeide and top dressing fertiliser. By the application of such a combination the mite would be checked, and at the same time the crop would be stimulated into vigorous growth. Top dressing of field crops is a profitable undertaking, and if for the one cost of application a combined miteeide and fertiliser is used, two purposes are served at the one cost of labour. The final results of the various experiments gave the conclusion that a mixture of Carbolic and Thomas's Phosphate or Superphosphate effectively destroyed the mite. It was found that the thorough mixing of the following gave excellent results:—1lb. of 15 per cent. Carbolic powder, 3lbs. Thomas's Phosphate or Superphosphate. When mixed it is advisable to use as soon as possible. It is wise to only mix sufficient for daily use. This dusting powder may be applied to small areas by hand; through a perforated tin; per medium of puffers or sulphur bellows. Over large areas a super spreader gives good results. The ordinary farm drill may be used by removing the tubes, and allowing the powder to drop on to a sloping board. The main object is to get a good even distribution of the dusting powder over and around all infested plants. It is recommended that at least one cwt. per acre be used.

Lime, tobacco dust, or some inert carrier may be used to mix with the carbolic powder. Any strength over four per cent. carbolic content has a tendency to burn some plants. By breaking down 1lb. of 15 per cent. carbolic with three pounds of any carrier you have roughly a four per cent. carbolic mixture. The time to apply the dusting is after 11 a.m. and up to sun-down on fine days. The mite does not become active until the foliage has become dry. If dust is applied to wet foliage it becomes largely inoper-

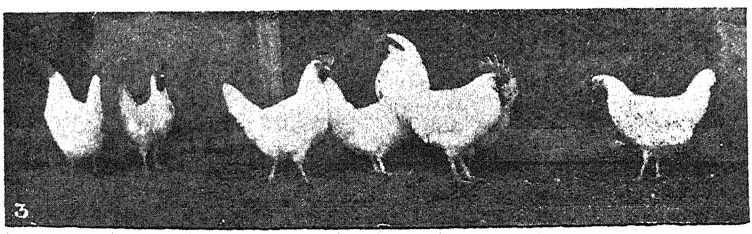
ative, owing to its caking on the leaves. Being purely a contact powder, it is only wasting material to apply if the mite is not present. The carbolic is the killing agent, and is very fatal to the mite, but has no effect upon the eggs. It is, therefore, necessary to repeat the operation after an interval of 10 days. The cost of this treatment, which is not excessive, is greatly offset by the extra returns received from an area so dressed. Another dusting powder which gives good results is made as follows:—half a kerosene tin of tobacco dust, half a kerosene tin of lime, half pint of kerosene. Add the kerosene to lime over night, mix all together and apply. Dusting powders, based on the departmental formula, are obtainable.

Black Leaf 40: 1lb. to 70 gallons of water, adding 3 lbs. of soap, is a very effective wash. The soap is shredded and dissolved in boiling water, and then stirred into the bulk. It is a contact wash, and only kills those mites that are reached by it. Apply with a spray pump or syringe.

Kerosene Emulsion:—Kerosene, 2 gallons; Sunlight soap, ½lb.; naphthaline, ½oz. Dissolve the naphthaline in the kerosene. Boil the soap in one gallon of water. When boiling remove to another vessel, add the kerosene and naphthaline and churn violently for 10 minutes. This will form a creamy mass, which thickens on cooling. This constitutes a stock solution. When using, add one part to eight parts of water, and apply with spray pump.

Note.—Being a sap sucker, it is useless spraying with poisons such as Arsenate of Lead, Paris Green, or any other internal poisons. Contact sprays or powders only are effective, and the success of these depends on the thoroughness of application.

Summary.—The Red Legged Earth Mite attacks nearly all cultivated vegetables and garden flowers. It also attacks clovers, oats, peas and other field crops. It occurs in harmful numbers during the wet season from May to October. It is worst on light, loamy soils and sandy country. It can be largely prevented by clean cultivation and fallow, and can be destroyed by contact dustings and sprays.



POULTRY NOTES.

W. T. RICHARDSON,
Poultry Adviser.

CHICKEN POX (WARTS).

This disease is frequent in hot climates, such as ours, and recurs in the Autumn. First season birds—cockerels and pullets—are subject to it, particularly so when late hatched, and frequently whole flocks are affected. Matured birds are rarely attacked.

Like with many other poultry complaints, sanitary surroundings play a leading part in checking its appearance and progress. To expect birds to be in the best of health in dirty yards and houses is to expect the impossible, and sooner or later they will become victims of their owner's neglect.

Prevention is always better than cure, and this applies to Chicken Pox, also known as Warts, and measures have to be taken before this diseases puts in an appearance, so that in case of an outbreak it may be easily and speedily checked.

Start with your yards and see that your birds are in clean, healthy surroundings. Remove all droppings and litter at regular and frequent intervals, long before any accumulation of dirt stares you in the face.

The symptoms of Chicken Pox are generally visible from the out- Light coloured patches or points, frequently round in shape, and in vary numbers and size, break out on the face, wattles or comb. They reach t maximum size in four to six days. These patches extend rapidly and in e become yellowish in colour; matter forms, they quickly ripen, become is brown, and develop into a hard dry scab, often extending till the eye completely covered. If not attended to, the bird is likely to die from starv- tion unless hand fed, or lose the sight of one or both eyes.

As this disease is both infectious and contagious and spreads rapidly, affected birds should be isolated immediately and the houses and perches disinfected with carbolic acid in five per cent. solution.

According to Ulenhuth, Schmid, Sigwant, and others, the virus of Chicken Pox is capable of causing avian diphtheria (roup).

Treatment should commence long before Chicken Pox is prevalent, the object being to build up the system to resist the outbreak. Start on the first week in January, and for three consecutive weeks give Epsom Salts twice weekly at the rate of one ounce packet to the gallon of drinking water. For the next three weeks add Sulphur to the mash (wet or dry) twice weekly in the proportion of one ounce to fifty adult birds (five months old or over), younger birds in proportion. Keep alternating Epsom salts, then sulphur, every three weeks, as above, till well into May. By following out this treatment very little trouble should be experienced.

Should Chicken Pox break out, however, paint the patches or sores referred to with tincture of iodine, a 2 per cent. solution of formalin, or an ointment of glycerine, vaseline or lard, containing 2 per cent of carbolic acid and 70 per cent. alcohol, every other day.

In advanced cases remove the warty growths, bathe the head thoroughly with a 2 per cent. permanganate of potash solution, or peroxide of oxygen, and when dry paint as above.

A liberal supply of green stuff, fed regularly with, or independent of, the mash will materially help to ward off this disease.

Poultry-keepers should bear in bind that affected pullets will go off the lay. This must be guarded against, as warts are prevalent when eggs realise top market prices for the year.

THE USE OF DRY PICKLED WHEAT FOR POULTRY.

W. T. Richardson,
Poultry Adviser.

Several inquiries have been received regarding the probable effects of feeding fowls on wheat treated for smut with copper carbonate, and doubts existing as to the results of such feeding, two tests have been conducted recently with wheat prepared by the Government Botanist, particulars of which are as follows:—

No. 1 Test.

Commenced 14th October. An aged hen (Orpington-Leghorn cross) was fed twice daily on wheat treated with copper carbonate—2 ozs. to the bushel—till the 21st October with no apparent harmful effects. Thence the strength was increased to 4 ounces to the bushel of wheat and fed twice daily till 28th October inclusive, with negative results. During the test this hen laid a number of eggs.

Approximate quantity consumed—

1½ lbs. dry pickled wheat, 2 ozs. to the bushel.
1½ lbs. dry pickled wheat, 4 ozs. to the bushel.

No. 2 Test.

From 29th October till 7th November, inclusive, one White Wyandotte Cockerel, about three months old, was fed daily on treated wheat (4 ozs. to the bushel) and showed no harmful effects at the conclusion of the test.

Approximate quantity consumed—

2 lbs. of pickled wheat.

Both birds were post mortemed after the test and, notwithstanding the fact that in both tests treated wheat to twice the strength used in dry pickling was fed, their internal organs showed practically normal conditions, the exception being a few pin head haemorrhages in the heart and caeca.

COOKING OF MEATS.

MARGARET A. WYLIE,
Inspectress and Organiser, Domestic Science Classes.

Boiling meat is a more economical method of cooking than either roasting or baking; it requires less fuel and labour, and the meat loses less in weight; the meat is rendered very digestible. The flesh of young animals loses much of its bulk in boiling, because the albumen and fibrine of which the young tissues are composed are dissolved in the water.

Boiling Meat.

1. Wipe, weigh, and trim the joint.
2. Allow time for cooking. This is the same as for baking, *i.e.*, 20 to 25 minutes for every pound, and 20 minutes extra.
3. Put the meat into boiling water. Boil 10 minutes to set the outside albumen.
4. Simmer for the remaining time.

Salted Meats.

Salted or pickled meats are cooked a differently from fresh meats. Here is found the exception to the rule as regards placing the meat in boiling water to harden the surface albumen. The salt used in the pickle closes the cut surface of the meat so much so that it requires opening a little to enable the fibre throughout the joint to be softened and made tender. The following directions are suitable for corned beef, corned mutton, and pork:—

Time for cooking—

1. Allow 25 to 30 minutes to every pound.
2. Wash the surface of the meat quickly in cold water.
3. Place in a pot of lukewarm water with one tablespoon of lemon juice or vinegar. (The acid helps to soften the fibre.)
4. Bring slowly to boiling point, and then let it simmer for the remaining time.

Facts about meat.

There is a large amount of water in meat, for instance—

1lb. beef contains ¾lb. water, ¼lb. nutritive substance.
1lb. mutton contains ¾lb. water, ¼lb. nutritive substance.
1lb. pork contains 3/5lb. water, 2/5lb. nutritive substance.
1lb. fat beef contains ½lb. water, ½lb. nutritive substance.

On this account ovens should be provided with valves or ventilators to permit of the escape of steam. If it does not escape the outside of the meat cannot become crisp, and loses a lot of its valuable flavour.

The average loss in weight during cooking is:—Roasting, 30 per cent.; baking, 25 per cent; boiling, 20 per cent.; frying, 15 per cent; steaming, 15 per cent.; grilling, 12 per cent. During the cooking of meats an appetising substance, termed osmazone, is developed. This helps to stimulate the flow of gastric and other digestive juices.

Roasting.—The flavour developed in the browning of meat is spoiled when the fat is too hot. This overheating divides the fat into fatty acids and glycerine, and forms a substance known as acrolein which is irritating to the membrane of the stomach. This overheating or burning of fat must be guarded against whenever fat is used in the cooking of meat.

Stewing.

Stewing is cooking meat in a small quantity of liquid for two or three hours. By this plan the gelatine is extracted from the bones, the juices drawn out to form gravy, and the fibrous parts rendered digestible.

This is a nourishing and economical method of cooking meat, as the cheaper cuts may be used to advantage, and as the meat is served in the gravy there is no waste.

There are two classes of stews—brown and white. Brown stews are made chiefly from beef and mutton; white stews from tripe, rabbit and veal. They are best cooked in a double saucepan, thus obviating the need for constant attention, but the work may be carried on at the side of the stove with very little firing. Stews are started with cold liquid, and then brought to boiling point and kept simmering. For brown stews the meat is fried lightly first to improve the flavour and appearance of the dish. They may be thickened with browned flour, wheat meal or sago. White stews should be cooked in a white-lined pan. They are usually thickened with flour and enriched with milk.

For varieties and directions for stewing, I would refer our readers to "The Golden Wattle Cookery Book," published by E. S. Wigg & Son, Perth.

Salting and Pickling Meat.

Pieces of meat suitable for pickling are:—Round of beef, leg of mutton, ox tongue, leg of pork, hand of pork, sheep's tongues; but almost any cut of meat may be preserved by pickling.

The general requirements are:—a large earthenware crock or a clean barrel, tight enough to prevent leakage. A cover of thick hessian or bagging with a loose board cover weighted down.

The following recipe for the preparation of brine is a good one:—6lbs. salt or 3lbs. common salt, 3lbs. bay salt, 2lbs. white sugar, 2ozs. saltpetre, 3 gallons of water.

Method.—Boil these ingredients for half an hour. Skim and cool. Pour into the barrel. Place in a cool place.

1. The meat should hang for a day or two if possible.
2. Remove the kernels and pipes and unnecessary flaps.
3. Rub the surface with dry salt and, if possible, allow to stand another day. Turn each day and rub again with salt. Drain well.
4. Immerse in the brine. Packs cuts as closely as possible, taking care to cover well with the brine. Cover with bagging and weighted lid.

The pickle for meat may be used again and again, if boiled between each pack and extra water and fresh salt added. Sugar makes the meat more tasty. Saltpetre colours it, but tends to make it dry.

Meat may be kept in this way for two or three weeks, but will be ready for use in about five days.

To Cook a Ham.

Method No. 1—

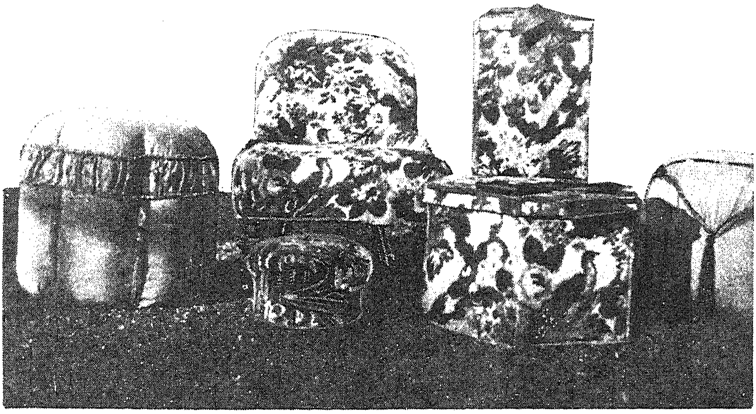
1. Soak the ham for 12 hours. Scrape well.
2. Place in a boiler with sufficient cold water to cover.
3. Bring to boil. Skim well. Draw to side of the fire and simmer until cooked. Allow 25 to 30 minutes to the pound, according to the thickness of the ham.
4. When ready, remove skin and trim neatly.
5. Sprinkle thickly with browned bread crumbs.

No. 2—

1. Soak ham for 12 hours. Scrape well. Dry.
2. Prepare a paste of 2lbs. flour and water.
3. Roll out paste and wrap it round the ham.
4. Place in baking tin with a cup full of dripping.
5. Bake in a moderately hot oven three or four hours. Baste frequently.
6. Remove skin, trim neatly. Sprinkle thickly with brown crumbs and grated nutmeg.

COLLAPSIBLE SOILED LINEN BASKET FOR BEDROOM USE.

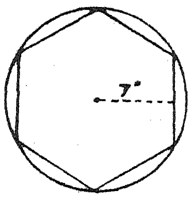
Miss M. A. Wylie,
Household Management Centre, Education Department.



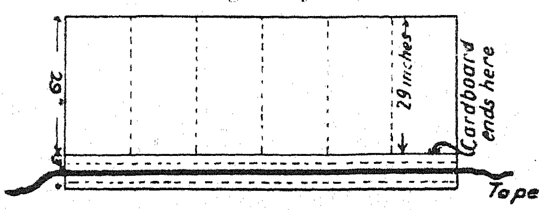
A few of the articles made at the Hous ehold Management Classes, James Street School.

Material.—2 yds. cretonne; 1¼ yds. narrow ribbon; 2 yds. lining; 1½ yds. wide ribbon: three sheets of extra strong strawboard.

1. Draw a hexagon with a 7in. radius for bottom.
2. Cut sides 7in. x 29in. (six pieces).
3. Draw a hexagon with a 7⅛in. radius for lid.



4. Cut sides of lid 7⅛in. x 1½in. (six pieces).
5. Cut material 45in. x 33in. and place right side of material together, then machine across top and down one side. Turn right side outside and press.
6. Place first long strip of strawboard in, fit tightly, tack or machine as close to strawboard as possible.
7. Repeat for the next four strips; the last one must be top sewn, first turning in cretonne and lining neatly.

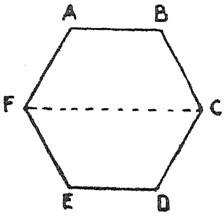


8. Make a "heading" for tape at bottom.
9. Top sew the first and last sides together.

10. Thread tape through and draw to fit.

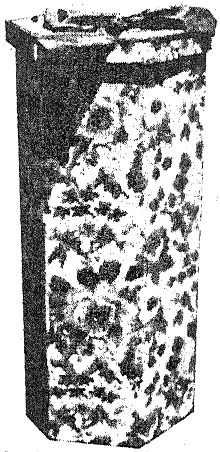
11. *Bottom and Lid.*—Cut material and lining one inch longer all round than strawboards.

12. Place cretonne and lining together and sew three sides F. to C. by machine. Turn right side out and press.



13. Place cardboard in; turn in edges and top sew.

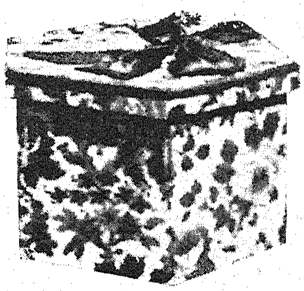
14. For lid, cover the six small pieces of cardboard with cretonne and lining, and top sew to the larger hexagon. Sew small ribbon over edge and trim top with a large bow.



Soiled linen basket made from cardboard and cretonne (hexagonal basis).

15. A *hat-box* may be made with same directions on a base of a 10in. hexagon for box and 10⅛in. for lid.

Side pieces to be 10in. x 12in.



Hat Box made on hexagonal basis—made from cardboard and cretonne.

A *waste paper basket* is made with a 5in. base and sides 5in. x 16in. No lid is required.

THE GENESIS OF THE RABBIT.

C. J. CRAIG,
Chief Inspector of Rabbits.

Some of the early records of the various settlements in Australia make reference to the introduction or existence of rabbits, but whether these records refer to grey rabbits or to the white furred, pink-eyed variety is not clear.

It is apparent that rabbits accompanied the expedition that founded the settlement on the shore of Port Jackson on 26th January, 1788, for a return issued by Governor Phillip on 1st May of that year, and printed in the Historical Records of New South Wales, shows that the live stock on the settlement included rabbits. Whether they were white or grey rabbits is not stated, but it is believed they were the former. Many of the early colonists kept white rabbits in hutches, and there was a considerable traffic in them in the market places. From time to time many escaped from captivity, and sought shelter under the houses about the settlements. Either they were unable to survive the conditions in the wilds, or they were by nature or experience more fitted for a semi-domesticated existence, for they usually remained about the inhabited areas, and did not appear to travel far into the surrounding country.

It is believed that navigators of the time, possibly for the purpose of providing food for any vessel passing later, brought out a number from England or the Continent, and released them upon the islands along the coast. It has been reported that they were numerous on Rabbit Island, close to Queenscliff, in the early forties. Flinders Island, which is adjacent to Tasmania, was at that time a settlement for the aborigines deported from Tasmania, and its inhabitants were sometimes supplied with rabbits taken from Rabbit Island, as also were the whalers.

According to press records the Black Ball clipper "Lightning" arrived in Hobson's Bay on the 25th December, 1859, having on board four hares, 66 partridges, and 24 wild rabbits, consigned to Mr. Thomas Austin, of Barwon Park. These rabbits were the first to become acclimatised upon the mainland, survive the attacks of their natural enemies, and spread into the adjoining country and beyond.

When they once became established, many landholders from other parts sought, as a great favour from those that already had them, two or three pairs with which to stock their estates, and were extremely grateful to be the recipients of such esteemed gifts. One landowner at least, as a considerate provision for their comfort and safety, had constructed, prior to their arrival, hutches and artificial burrows in the sandy hillocks upon his estate, and took every precaution to protect them. For an employee to be caught killing one meant instant dismissal. In some instances a gamekeeper was kept to kill off the native cats, and so protect the rabbits. Another landowner from Glenisla procured a dozen rabbits at £1 each, so that his children might have some good shooting in a few years' time. That landowner afterwards stated that those dozen rabbits had eventually cost him £1,000 a head.

About 1860, at attem|t was made to farm rabbits and to dispose of the carcases for consumption, as is shown by the following extract taken from a copy of the Castlemaine "Advertiser," published in 1863, under "Rabbit Growing":—

"In these days when so much attention is directed to the introduction of new industries, it will be interesting to our readers to know that for the last two or three years there has been started a most novel and useful speculation which, while it will return a very handsome profit, we hope, to the spirited originators, it will prove a vast service to the community. We allude to the large rabbit warren established by Messrs. Gravenor and others beyond Guildford. Upwards of 200 acres of land, hill and dale, have been fenced in with seven-foot pailings sunk two feet in the ground, and originally about 50 couples of rabbits were turned out about two years ago. With extraordinary fecundity for which bunny is celebrated, these fifty have increased to so many thousands. So much so that in a few weeks the proprietors will be in a position to regularly supply the neighbouring markets of Castlemaine and Daylesford, and will soon extend their operations to Sandhurst and the great metropolis. The great relief, in summer time especially, of being able to obtain some unusual food other than the eternal mutton and beef of the good old times, makes this enterprise of considerable interest to the public, and the large revenues which the owners of extensive rabbit warrens in England obtain, point to the speculation as one which ought to amply repay its spirited originators. We should not omit to state that the most extreme care is exercised to prevent depredations either by wild dogs or dishonest men. A night watch is systematically kept. This new industry has been introduced unaided by the State, the land having been purchased by the proprietors. We can only say that we trust that their pluck and patience will reap the reward so eminently due."

The paling fence was afterwards destroyed by a bush fire, and the rabbits escaped to the surrounding country, and eventually spread over the whole district.

It cannot, of course, be said with absolute certainty that the couple of dozen wild rabbits introduced by the late Mr. Austin, were those only of their kind that had ever been brought to Victoria, but no authentic record of any other importations appears to exist, and everything points to the Barwon Park rabbits having been the real originators of what soon became known as the rabbit pest. Three years after their arrival they had attained such numbers as to be already looked upon as a nuisance in the locality. The other imported game—hares and partridges—were reported to be thriving well; but, according to the "Argus" of that day, they were completely outstripped by the rabbit.

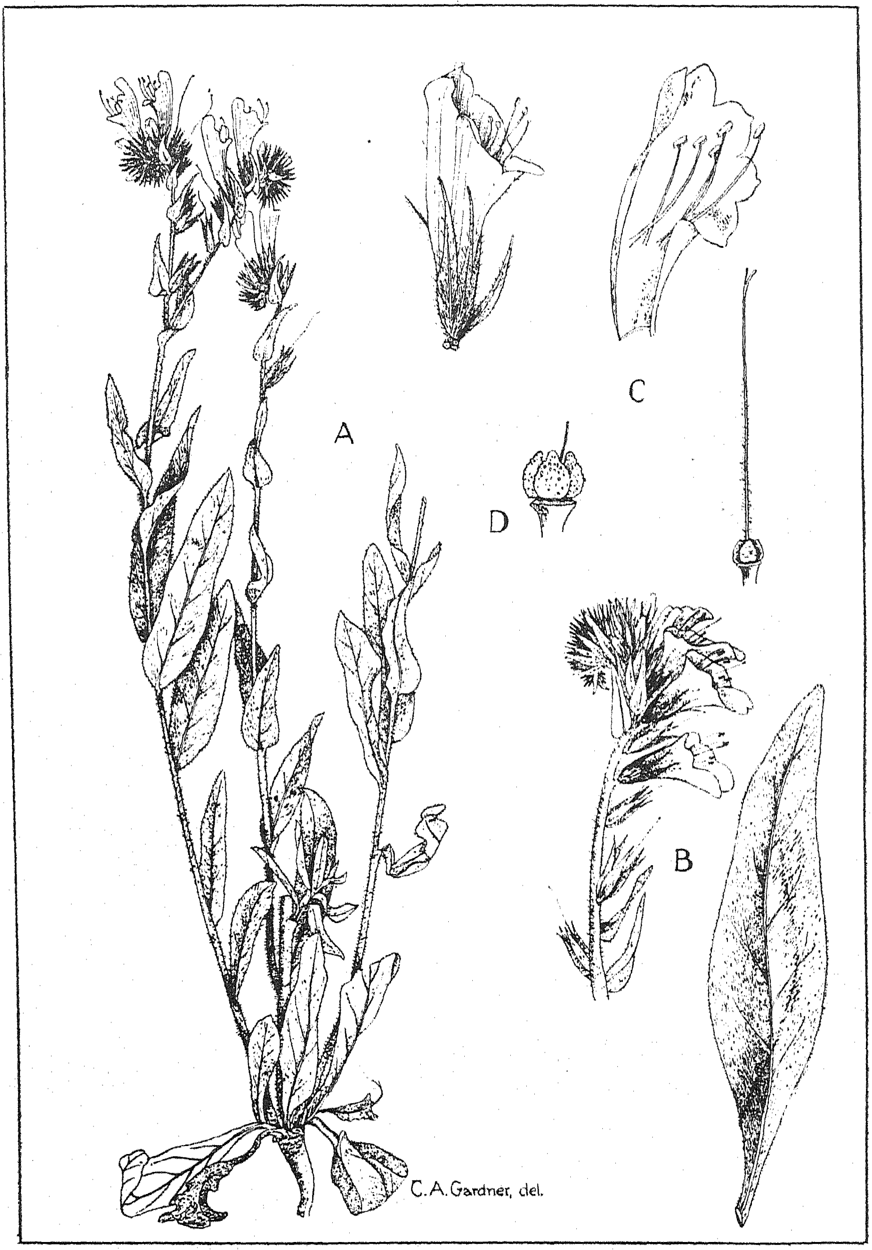
Bunny soon started travelling, following up the Barwon River and its tributaries, thence out across the northern and western plains—marching on and ever onward, till at long last he has bumped up against the Indian Ocean on our shores here of Western Australia. It seems somewhat curious that the trend of the rabbit advance should always have been westward and northward. In places where the features of the country or other conditions specially invite them, they will of course make their way in other directions, but in the main the tendency is towards the north-west resembling very much a bush fire with a south-east wind behind it, their progress north-westward is impetuous and rapid, whereas they work to the east and south

very slowly, as the bush fire eats its way back against the wind. This is well illustrated by the fact that it took the rabbits just as long to make their way from the Barwon near Geelong into the heart of the Gippsland district, as it did for them to travel from the same starting point into far off Western Australia.

From the earliest stages of his peregrinations, the rabbits first appearance in a district has always aroused considerable interest, but seldom anything approaching to dread. To the Australian boy, bred in an infested area, the presence of bunny was an unending source of holiday enjoyment, and no doubt many will be inclined, like the writer, to say that one of their greatest delights, as soon as they were old enough to carry a gun, was to stand over a warren in which ferrets were operating, and bang away at the rodents as they broke cover and bolted in terror from their little pink-eyed tormentors; or to stalk them in the gloaming as they emerged from their "dugouts" in search of their evening meal. To many of those of larger growth bunny's presence was viewed in a more practical light, and the forwarding of well-stocked crates of carcases twice a week to the nearest market brought in a very comfortable living. No wonder that the rabbit had fewer enemies on his first establishment in districts in the sixties and seventies than friends. But there was trouble in store, for by-and-by it began to dawn upon the authorities that these busy little quadrupeds were becoming rather over ubiquitous and might possibly develop into something like a nuisance, so in the year 1880 the first Rabbit Act was brought into force. The Government was a long time, however, in getting things under weigh, and it was not till 1884-5 that it became thoroughly aroused. The increase had in the meantime become so alarming as to make active measures imperative, and the work of suppression was at last set about in earnest. The first year's effort in this direction, though no doubt appearing considerable in those days, was a comparatively small one, the outlay amounting to only £1,284. As the years went on the expenditure increased (and so did the rabbits), the sum spent during 1885-6 being £24,833, and by the end of 1888-9 the cost of destroying and fencing had reached almost £170,000.

That the purpose of the expenditure was far from accomplished, however, is shown by the fact that a few years later 10,000,000 rabbit skins were exported from Victoria in one season, and the following year 118,000 carcases were sold in the Melbourne markets.

The over-running of Victoria was soon followed by the infestment of South Australia, and that colony also found herself forced to take active measures to meet the invasion. The fight proved a formidable one. From January, 1884, to December, 1888, a little more than £502,000 of public money was spent in trying to overcome the enemy. Although New South Wales began with the modest outlay of £490 in her first year (1883), by the time she had reached the end of 1889 she had paid away—as the result of Mr. Thomas Austin's acclimatization proclivities 30 years previously—considerable more than one million pounds.



Paterson's Curse (*Echium plantagineum*, Linn.)

A.—Plant.
B.—Inflorescence and leaf.
C.—Flower and section of same (enlarged).
D.—Fruit (enlarged).

PATERSON'S CURSE.

(*Echium plantagineum*, Linn).

W. M. CARNE, F.L.S., and C. A. GARDNER.

Paterson's Curse is an annual or biennial herb now fairly well established in some parts of Western Australia. Its native home is the Mediterranean region and Western Europe, where it is known to the British as Viper's Bugloss, and is cultivated to some extent in gardens.

The earliest known record of its introduction into Australia is near Albury, in New South Wales, where it was grown as a garden plant. Spreading from here into a stock reserve, it became gradually distributed over many districts in the Eastern States, where it is now common.

Paterson's Curse is known in South Australia as "Salvation Jane" or "Blueweed." The name "Paterson's Curse" is after a certain Paterson, from whose garden it is supposed to have spread.

Its history in Western Australia is connected with the construction of the Great Southern Railway. Lady Campbell, wife of Sir Thomas Campbell, who was residing at the time not far from Broomehill, introduced this species as a garden plant, and from here it has become widespread, and is still known along parts of the Great Southern Railway as "Lady Campbell weed."

The name *Echium* is from the Greek *Echis,* meaning viper: hence the name of Viper's Bugloss. *Plantagineum* is from the resemblance of the leaves to Plantago, the Plantain.

Paterson's Curse has been reported in this State from various places along the Great Southern Railway; Donnybrook, Brookhampton, and Bridgetown in the South-West; Wooroloo, Swan View, Darlington, and Guildford, and from Gingin and Mingenew. It has not been officially recorded from the Eastern districts.

Around Broomehill and Kojonup it occurs very extensively in the paddocks, often covering large areas, and the same has been said of the plant in the Blackwood district. Further north it is more sporadic, but there is always the possibility of its spreading, and if unchecked may become very common.

Description of Plant.—An annual or biennial herb of usually 1 to 2½ feet, rarely 3 to 5 feet high, branching at the base with several erect stems, stout and hairy. Leaves mostly basal, the basal large and oval-lance-shaped, stalked, the upper leaves smaller, without stalks and heart-shaped at the base. Flowers reddish-purple, in long curved racemes: each flower subtended by a leaf-like bract. Calyx deeply divided into five acute lobes: hairy with stiff white hairs. Corolla tubular, bell-shaped, about three times as long as the green calyx. The fruit consists of four small wrinkled nuts, which fall out of the base of the persistent calyx. The flowering season is September to November: the plants seeding about the same time, or into December.

Paterson's Curse germinates and stools out in winter, and sends up its flower-bearing stems in the spring. The plants make their best development in fairly rich soils. The weed only occurs at present in the areas of higher rainfall: it does not appear to withstand the dry conditions of the Eastern districts.

There are two objectionable features of Paterson's Curse. In cereal crops it is particularly troublesome in crowding out the growing crops, and interfering with harvesting operations. In pasture lands it crowds out more valuable annual pasture crops and considerably reduces the dry feed value of the pasture. It is not likely to prove as troublesome in good permanent pasture land, since the more vigorous grasses, such as Couch and Paspalum, are able to compete with it, or even crowd it out.

Paterson's Curse has some value as a fodder plant, but it must be emphasised that this quality is not one to make the plant a particularly desirable one. The plants are eaten by stock when young. Where feed is scarce, it may be quite useful, providing a succulent spring feed. The mature plants, however, are fibrous, and harsh, and usually avoided by stock. Stock, however, will eat it if reduced to that extremity, but there is always a risk of the animals having digestive trouble. The weed has certainly received some praise from the drier areas of other States, hence the name of "Salvation Jane." Since these conditions do not obtain in our South-Western districts it is scarcely necessary to speak well of the weed on this account, and it should always be remembered that if other feed will grow, Paterson's Curse is not a very desirable plant.

Control.—The most effective control is heavy stocking by sheep. Where this is not possible hand pulling or hoeing in small areas, or cultivation in the larger ones, should prove effective. It is important to carry out these operations before the flowering commences, as the plants may, and often frequently, carry flowers and ripe fruits on the same branch. The flowers also may continue to develop on the uprooted plants. The weed burns badly when dry.

FRUIT FLY.

Ceratitis capitata (Weid).

L. J. NEWMAN, F.E.S.,
Entomologist.

This serious fruit pest has made its appearance over a wide area, and gives evidence of being particularly plentiful during this fruit season. Owing to the dryness and mildness of the past winter and spring, there has been a more plentiful carry-over of the fly from autumn to early summer. This, coupled with the heavy crop of early stone fruits, paves the way for a rapid increase of the pest unless combined action is taken to combat same.

It is well that all growers should understand, whether they have one fruit tree or 1,000, that foliage baiting is now compulsory. Any grower whose fruit is found infested with the larva or maggot of the Fruit Fly is liable to prosecution, the maximum penalty being £25.

Not only must the trees be baited with an approved bait, but all fallen infested fruits must be picked up and destroyed by boiling, once every 24 hours. If possible do not allow infested fruit to lie in the hot sun, as this induces the maggots to leave and bury themselves in the soil before the fruit is picked up.

Growers forwarding maggot-infested fruits to markets, or exposing, or offering same for sale, are liable to its seizure and prosecution. The Department relies on growers notifying it when neglect on the part of any owner to do all possible to check the increase and spread of the pest is observed. It is only by the combined efforts of all that this virile insect can be controlled, and those growers who will not voluntarily do their part must be made to do so by law.

The new Regulations as issued in the *Government Gazette,* are as follows:—

1. Fruit Fly (*Ceratitis capitata*) is hereby declared to be a disease to which the provisions of Section 8a of the Plant Diseases Act, 1914-1925, apply.

2. In every orchard where Fruit Fly exists the occupier shall cause—(a) all fallen fruits to be gathered from the ground at least once in every twenty-four hours; (b) all fruits infested with larvae of Fruit Fly to be gathered from the ground and trees once in every twenty-four hours, and destroyed by boiling; (c) Fruit Fly bait, made in accordance with the formula hereinafter set out, to be applied in the manner prescribed in Regulation 4, once in every seven days, to all trees having fruits thereon, as long as such fruits are in a state of growth and ripeness which would enable Fruit Fly to use such fruits as a depository for eggs.

3. The formula for making Fruit Fly bait is as follows:—

   5ozs. paste arsenate of lead, or 2½ozs. dry arsenate of lead.
   4lbs. molasses.
   1 gallon fruit syrup (orange for preference).
   3 gallons of water.

4. Fruit Fly bait shall be applied to the trees with a hand syringe or small spray pump, using not less than one gallon of bait to 80 trees.

An illustrated Bulletin containing the life-history, and remedial measures is obtainable from the Department of Agriculture on application.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION SCHEME.

Conducted by Dairy Branch, Department of Agriculture, Western Australia—Results since July 1st, 1925

Name of Cow.	Owner.	Breed.	Herd Book No.	Age.	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.
MATURE COWS—5 YEARS AND OVER—STANDARD REQUIRED, 350LBS. BUTTER FAT.										
				yrs. mths.			lbs.	%	lbs.	lbs.
Treasure III. of Homeleigh	D. Malcolm	I.M.S.	4,648	5 0	9-1-25	273	9,924	4·88	484·99	23
Gentle of Blackheath	D. Malcolm	M.S.	11,679	5 1	13-10-24	273	9,903	4·49	445·02	11
Cheerful II. of Yarralla	A. H. Henning ...	Jersey	6,258	8 8	16-10-24	273	6,658	5·49	365·67	19½
Mermaid of Blackheath	D. Malcolm	M.S.	12,156	5 2	19-2-25	273	7,212	4·38	316·41	19
Lotus Queen of Wongamine	Walker & Co.	Jersey	10,064	6 1	20-5-25	90	2,010	4·74	95·31	14
COWS (OVER 4½ YEARS AND UNDER 5 YEARS)—STANDARD REQUIRED, 325LBS. BUTTER FAT.										
Mokine Lady Noble	Walker & Co.	Jersey	10,633	4 8	2-11-24	273	6,361	5·61	357·03	15½
COWS (OVER 4 YEARS AND UNDER 4½ YEARS)—STANDARD REQUIRED, 300LBS. BUTTER FAT.										
Sheila of Sarnia	D. Malcolm	Jersey	8,452	4 3	10-1-25	273	6,535	6·20	405·32	18½
Velvet of Wollongbar	Dept. of Agriculture ...	Guernsey	774	4 5	25-10-24	273	6,996	4·57	320·13	12
COWS (OVER 3½ YEARS AND UNDER 4 YEARS)—STANDARD REQUIRED, 275LBS. BUTTER FAT.										
Pet VIII. of Glenview	D. Malcolm	I.M.S.	4,647	3 8	3-1-25	273	4,848	5·06	245·69	11
SENIOR HEIFERS (OVER 2½ YEARS AND UNDER 3 YEARS)—STANDARD REQUIRED, 225LBS. BUTTER FAT.										
Countess VI. of Berry	R. Smith	M.S.	N.Y.A.	2 10	6-1-25	273	6,078	4·05	246·34	21
Blue Bell II. of Cowra	R. Smith	M.S.	N.Y.A.	2 9	13-12-24	273	5,690	4·21	239·56	21½
Primula II. of Berry	do.	do.	do. ...	2 6	14-12-24	273	4,615	4·47	206·61	8½

JUNIOR HEIFERS (UNDER 2½ YEARS)—STANDARD REQUIRED, 200LBS. BUTTER FAT.

Gibson Girl IX. of Berry	R. Smith	M.S.	N.Y.A.	2	5	4-3-25	273	8,050	4·11	331·40	28½
Rose of Waterside	Wooroloo Sanatorium	do.	do.	2	3	9-11-24	273	6,131	4·58	281·38	15½
Myrtle of Coura	R. Smith	do.	do.	2	0	27-12-24	273	6,300	4·36	274·64	20
Butterfly of Waterside	Wooroloo Sanatorium	do.	do.	2	3	29-11-24	273	6,141	4·43	272·23	17½
Bonnet II. of Berry	R. Smith	do.	do.	2	3	22-12-24	273	5,640	4·79	270·69	20
Pretty Polly II. of Coura	do.	do.	do.	2	5	1-1-25	273	5,675	4·55	258·31	21½
Daisy Rye of Grass Vale	R. H. Rose	Jersey	15,688	1	8	23-10-24	273	3,741	5·51	206·15	12
Sunlight of Waterside	Wooroloo Sanatorium	M.S.	N.Y.A.	2	2	24-12-24	273	3,510	4·53	159·14	10
Treasure of Sarnia	D. Malcolm	I.M.S.	do.	2	4	30-1-25	273	3,826	4·13	158·20	9½

365 DAYS' TEST.

Girlie of Sarnia	D. Malcolm	Jersey	9,992	5	9	21-8-24	365	12,750	5·17	660·00	27
Fancy of Liryclea	A. H. Henning	Hamel	6,674	6	10	24-7-24	365	11,210	4·91	550·57	5

APPLE SCALD.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

One of the best commercial varieties of late apples grown in Western Australia—"Granny Smith"—is particularly liable to develop "Scald" in cold storage, and for the purpose of testing prepared wrappers to control the trouble I obtained from Mr. Mauger, of the Westralian Farmers, Perth, two kinds, one put up by the "Kalamazoo Vegetable Parchment Co.," Michigan, U.S.A., known as "Anti-scald apple wrapper," and the other also an American production known as "Coronite Mineral Oil Fruit Wrapper."

I obtained the apples from T. Price, of the Illawarra Orchard Co., Karragullen, and as they were grown in one orchard there were no variations in soil or climatic conditions to cloud the results.

My experience shows that well matured, but not over-ripe apples, develop scald in a much less degree than apples which are stored in a green or immature condition, and those which I used in this test were in the correct stage of ripeness for storage when placed in the Government Cold Store in Perth on 6th June last.

Four cases of "Granny Smith" apples were used and kept at an average temperature of 33 deg.—

No. 1 was wrapped in "Anti-scald" paper.
No. 2 was wrapped in "Coronite" paper.
No. 3 was wrapped in Sulphite tissue paper (ordinary apple wrapper).
No. 4 was unwrapped.

The fruit was taken out of cold store and examined on 1st October, five days short of four months from the date of storage.

The only difference noticeable when the apples were unwrapped was a slightly more attractive appearance in those from case No. 1: the fruits in this instance being more yellow and with a greater degree of natural wax showing on the skins than was apparent on those from Nos. 2, 3, and 4.

No trace of "scald" was to be seen on any of the fruits at the time they were taken from the cases and unwrapped, but within 24 hours those from No. 4 commenced to develop it, and a day later those from No. 3 followed suit, though in a much less degree. Each succeeding day an increase in the affected area on the apples from Nos. 3 and 4 was manifested, but those from Nos. 1 and 2 ripened naturally with hardly a trace of the trouble.

On 10th October, which was the tenth day after the apples were removed from cold store, I examined every apple in the four lots and noted the following results:—

No. 1—130 apples, only 6 of which were very slightly affected with scald.
No. 2—120 apples, only 9 of which were very slightly affected with scald.
No. 3—106 apples, 53 of which were affected with scald; many of them badly.
No. 4—106 apples, 100 affected with scald; majority so badly damaged in appearance as to be unsaleable.

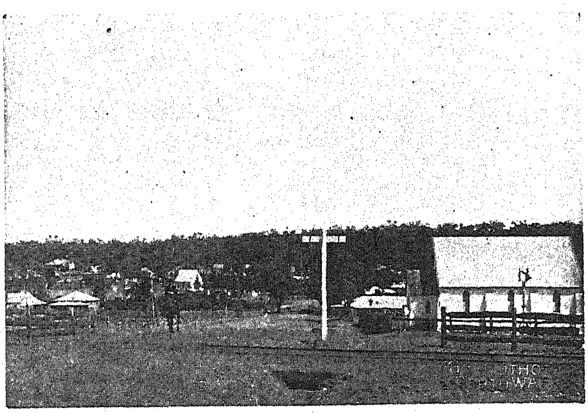
An interesting feature in this test, and one I had not previously noticed, was the number of apples in Nos. 3 and 4 that showed "scald" around the calyx, giving the fruits so affected the same outward appearance as "Cleopatras" have when affected with Mouldy Core.

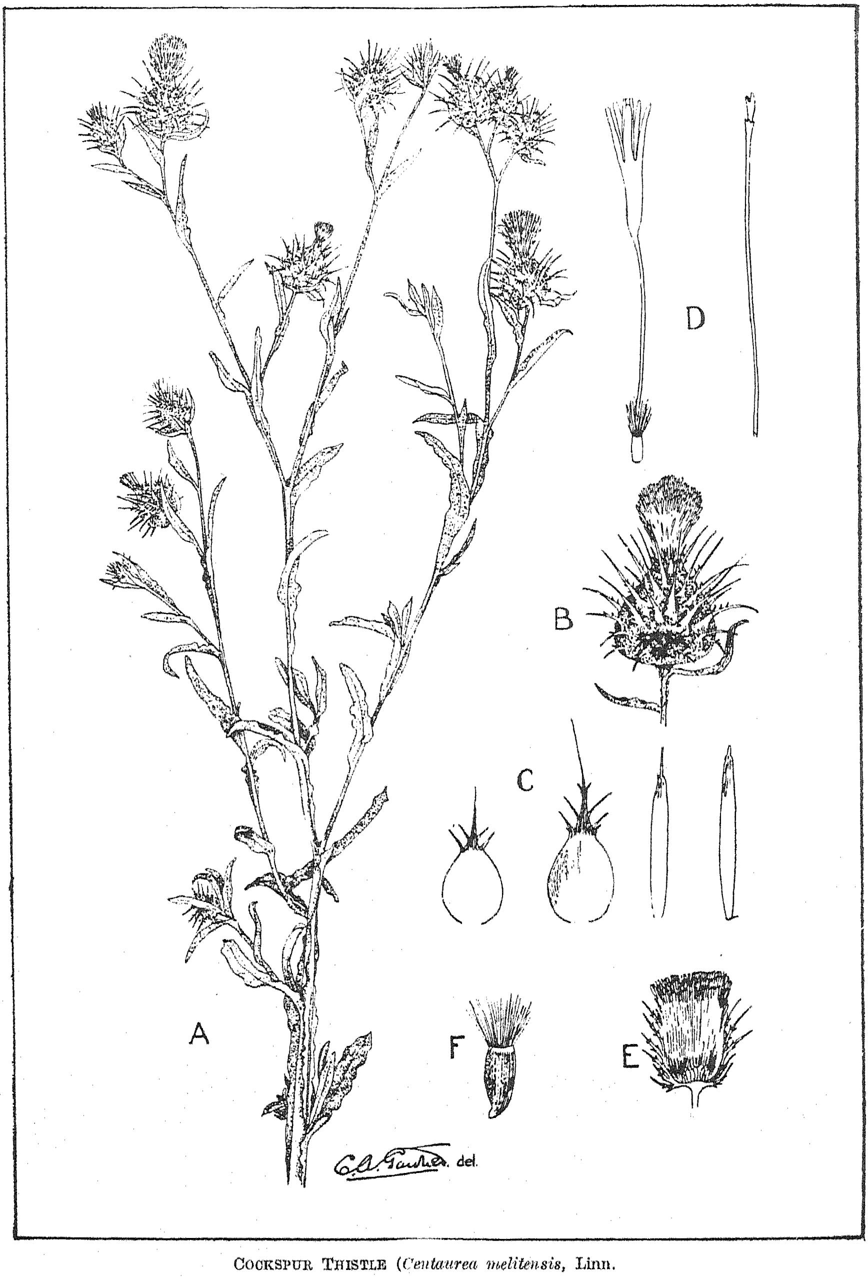
I kept 12 apples out of each of the lots 1, 2 and 3 wrapped until the 10th day to note if the paper after removal from store would, if left on the apples, retard the development of "scald." The results, however, were inconclusive, for although none developed in those kept from 1 and 2, the percentage showing in the unwrapped fruits from the same cases was so small, and the affection so slight, that no appreciable advantage was proved in leaving the fruit in the wrappers.

Of the 12 apples from No. 3 allowed to remain in the wrapping paper, 9 developed "scald," every one of these being affected around the calyx and most of them on other parts as well.

It will be noted that in the tests I made the paper used was an American production which was all I was able to obtain at the time, but since then I have had samples of oiled wraps from Messrs. Spicer & Detmold, Murray Street, Perth, which are prepared by the firm mentioned, and which I intend to use in making further tests next season.

To summarise.—The tests, though made with only a small quantity of apples, goes to prove that oiled wrappers will prevent "Granny Smith" apples from developing scald following on cold storage, and that it is a mistake to keep the variety named in cold store until late in the season either wrapped in sulphite tissue paper or unwrapped.





COCKSPUR THISTLE (*Centaurea melitensis*, Linn.

A.—Plant.
B.—Flower-head (capitulum).
C.—Bracts of the involucre (enlarged).
D.—Single floret and pistel (enlarged).
E.—Section of flower-head.
F.—Fruit (achene), enlarged.

COCKSPUR THISTLE.

Centaurea melitensis (Linn).

W. M. CARNE, F.L.S., and C. A. GARDNER.

Cockspur is an annual yellow-flowered thistle, now widely dispersed throughout the South-West and agricultural areas of Western Australia, but it is not a proclaimed noxious weed for any part of the State. Like other thistles, Cockspur is a member of the Daisy family, and its seeds, produced in large numbers, are chiefly distributed by the wind.

The generic name—*Centaurea*—is after Cheiron, one of the Centaurs of Greek legend, who is said to have used this plant and another to cure a wound in his foot, received from one of the arrows of Hercules. He died of the wound, however, bestowing his immortality upon Prometheus. The name *melitensis* means "of Malta," this species being a native to that country. On this account it is sometimes known as "Maltese Cockspur."

The range of Cockspur in Western Australia is very wide, extending from the South-West to the Victoria district, and Eastwards to the Eastern limits of the Wheat Belt. The date of its introduction is not known, but it has been naturalised here for a considerable period.

Like many of our other weeds, Cockspur has a certain value as a fodder plant, but this value is very limited. It is eaten by stock in the summer when other feed is scarce; the heads especially are the parts most frequently eaten by sheep. In crops, however, it must be regarded as a weed, but it rarely interferes with grain crops, as it is usually over-grown by the crops. In hay crops, however, it is more serious, since it reduces the value of the chaff, the bitter flavour and the spines which irritate the softer mouth parts making it disagreeable to stock. These spines also render the handling of the hay unpleasant.

Farmers usually regard this plant as more useful than harmful, but this is undoubtedly due to the difficulties attending its eradication. The seeds, which are produced freely are, in addition to being distributed by the wind, scattered by means of stock eating the plant in seed, or through chaff.

When there is no shortage of natural feed in the summer, Cockspur must be regarded as a weed with no advantages. Its presence in cereal crops indicates low-grade farming, *i.e.*, repeated cropping of the land, or unclean fallows.

Description of Plant.—An erect rigid annual, rather woolly on the stems and leaves. Stem leaves narrow, entire or almost so, continued down the stems below the insertion of the leaf as long narrow wings. Flower-heads terminating the branches, not stalked, egg-shaped. The receptacle has bristles between the florets. The bracts of the head have pinnately arranged lateral spines besides the long terminal one; the intermediate ones are the longest, and the inner ones have only one short terminal spine. Florets yellow, all tubular, the pappus bristly, of simple scale-like bristles.

Three species of *Centaurea* are recorded in Western Australia, and may be distinguished as follows:—

Flowers purple	C. calcitrapa.
Flowers yellow—	
Involucral bracts with a long spine and palmately-arranged spinules	C. solstitialis.
Involucral bracts with a short spine and pinnately-arranged spinules	C. melitensis.

Control.—The plant is so frequent in places not well controlled, such as roadsides and waste lands, that there is always a possibility of its invading adjacent farms. Systematic farming, with the practice of weed-clean fallows, and the running of sheep on young growth in the fallows will probably keep it in check. When chaff is purchased it should be free from Cockspur, otherwise stock will distribute it.

THE PLANT DISEASES ACT, 1914.

The Plant Diseases Act of 1914 represents one of those measures which, at some time or other, is necessary to be thrown over an industry for its preservation. It was first introduced into Parliament in 1913 as an amendment to the Insect Pests Act, but did not succeed in getting past the Upper Chamber. In the following year, however, it was again introduced with amendments submitted by the executive council of the Fruit Growers' Association, when it became law. It had, therefore, the benediction of all parties to its creation, and while it confers comprehensive powers on those whose duty it is to administer them, they were the recognised necessity by those who sought to suppress and control any plant diseases immediately it made its appearance in this State, or better still, to prevent its importation. For this latter purpose the Act gives power to prohibit the introduction into the State of anything infected with disease, and ports of entry may be proclaimed as quarantine stations and officers appointed to enforce compliance with the provisions of the Act. It is well for the orchardist to bear in mind that within twenty-four hours of his becoming aware of the presence of such a disease he must give written notice to the inspector, and that this duty devolves upon the occupier of any land used for the purpose of growing or cultivating plants, whether it be a garden, farm, vinery, vineyard or hothouse, and in fact any place where a plant is or has been cultivated and grown. By an amendment, which was introduced during the 1924 session of Parliament, it is also obligatory upon the occupier, upon becoming aware of the disease, to adopt such measures as are prescribed for its eradication and for preventing its spread. He must also permit any inspector to examine his orchard and premises, and should the inspector discover disease

the owner and occupier must comply with his instructions as regards combatting it. For this purpose the inspector is empowered to examine fruits, plants, coverings, goods and other things, and may even dig up plants and open packages. He may also stipulate a time limit for the commencement and completion of the work of eradication, and both the owner of the premises and the occupier are responsible for compliance with his requests.

Should the owner or occupier fail to comply with his instructions, then the inspector may do the work or have it done, and recover the expense from either the owner or the person in charge.

The inspector has also power to board any vessel for the conveyance of fruit; he may examine any structure used for its storage, and do all such things as he deems necessary in the discharge of his duties.

On a report that disease exists, the Minister may declare an orchard and land contiguous to it as an infected area, from which no plants may be removed without the inspector's permission.

In addition to destroying plants that are affected an order to destroy prunings may be made, but in this respect it is possible to obtain a certificate of exemption in regard to prunings required for propagation purposes.

Another point is that, although land held *may not be affected* by a disease, for the purpose of preventing contagion the inspector may order the orchardist to take such measures as he may think necessary. Young plants are not to be grown near trees in bearing, if intended for sale and, so that this provision can be safeguarded, power is given to interrogate the vendors of fruits and plants.

Again, the destruction of abandoned orchards may be authorised, and it is well to remember that an abandoned orchard is one that has been habitually neglected or for a long period left uncultivated.

If, despite all precautionary measures taken, prohibited plants should find their way into the State, or if any attempt be made to introduce or export such plants, the officers appointed for the administration of the Act are empowered to seize them.

Another feature of the Act is that where work has to be done in fighting disease, if it is necessary owing to the negligence of the occupier, the owner can recover expenditure incurred from the person in charge. On the other hand, if the expenditure is brought about through the fault of the owner, and not the person who is occupying the land, then the latter has a like right of remedy against the owner, subject, of course, to any agreements that may exist between them on the question of tenancy. To facilitate the work of suppression and prevention, right of entry is conferred on both the owner and occupier of an orchard, etc.

Such are the main features of the Act, which gives the customary power for the making of regulations, and under which penalties ranging from five to one hundred pounds may be imposed for breach and default.

THE WORLD'S WHEAT SUPPLIES AND REQUIREMENTS.

(From 1st August, 1925, to 31st July, 1926.*)

The International Institute of Agriculture, Rome, through its Bureau of General Statistics, publishes some interesting information concerning the World's Wheat Supplies and Requirements, which is hereunder set forth for the benefit of our readers. The article is taken from the October issue of this year of the International Crop Report and Agricultural Statistics.—[ED.]

I.—EXPORTABLE SURPLUS.

The statistical information at our disposal is sufficient for an estimate of the quantity of wheat that should be available for export, at the beginning of August last, from the most noteworthy of the exporting countries. On the basis of this information, the quantities available for export at the opening of the commercial season, 1st August, 1925, to 31st July, 1926, were, from Canada 175 million centals, from the United States 41½ million, from India 1½ million, from Argentine 26½ million, and from Australia 7 million centals. (See Table I.)

As regards other exporters the bases required for estimates are less trustworthy. The Balkan and Danubian countries (Roumania, Bulgaria, the Serb-Croat-Slovene State, Hungary), Algeria and Tunis have reaped harvests surpassing their individual requirements; but the quantity which these countries are in a position to export during the season 1925-26 can only be somewhat roughly estimated, since no data of their stocks on hand are in existence, while their *apparent* consumption (on the basis of production and of international trade) has afforded very variable arithmetical results, and thus becomes a very doubtful basis for estimating their probable requirements of wheat during the current season. The available information tends to the conclusion that the aggregate exportable surplus in the countries mentioned is about 44 million centals (Roumania about 13 million, Bulgaria 4 million, Serb-Croat-Slovene State 9 million, Hungary 9 million, Algeria, Tunis and other minor exporters outside of Europe 9 million centals).

Still greater uncertainty enshrouds the possible exports of the Soviet Union. The wheat harvest in those territories is decidedly larger than that of the previous year, and, according to official estimates furnished to the Institute, surpasses it by about 170 million centals. An estimate published in a Soviet Official Review places the quantity of wheat exportable during the season 1925-26 at 73 million centals. Bad weather during harvest and more recently should reduce these forecasts of quantity, while the quality must also have suffered. Taking into account the special circumstances of grain trading in the Soviet Union, it seems prudent to confine the probable export figures to a quantity which may vary between 22 million and 44 million centals.

In the aggregate, the quantity of wheat available for export at the beginning of August last, should therefore be about 330 million centals.

TABLE I.—WHEAT (GRAIN AND FLOUR REDUCED TO EQUIVALENT IN GRAIN).
Quantities Exportable on 1st August, 1925.
(Million Centals.)

Countries.	Total quantities available at the opening of the current season. †			Estimated consumption during the current season. †	Quantities available for export at the opening of the current season. †	Exports from the beginning of the current season. † until 31st July, 192.	Quantities available for export on 1s August 1925.
	Yield in the crop-year: *Northern Hemisphere* 1925, *Southern Hemisphere* 1924–25.	Exportable stocks on hand at the opening of the current season. †	Totals.				
Canada	235·1	10·0	245·1	70·0	175·1	...	175·1
United States ...	418·4	24·0	442·4	396·0	46·4	4·8	41·6
India	194·8	9·0	203·8	198·4	5·4	3·9	1·5
Argentina ...	114·7	6·2	120·9	40·8	80·1	53·4	26·7
Australia... ...	96·8	...	96·8	27·0	69·8	62·6	7·2
Total ...	1,059·8	49·2	1,109·0	732·2	376·8	124·7	252·1

† The current season is defined as follows:—From 1st August, 1925, to 31st July, 1926, for *Canada*; from 1st July, 1925, to 30th June, 1926, for the *United States*; from 1st April, 1925, to 31st March, 1926, for *India*; from 1st January to 31st December, 1925, for *Argentine* and *Australia*.

This quantity will be supplemented at the beginning of 1926 by the exportable surplus of the new southern hemisphere crops, now making progress towards ripening. In Argentina a larger area has been sown, and the crop prospects are, at present, favourable. In Australia the area under wheat is not quite as great as in 1924, and the crop condition, despite insufficient September rainfall, was still fair at the beginning of October, though further rains are needed if good yields are to result. At present it may be expected that the aggregate of these two southern crops should reach the same figure of 210 million centals as that secured last season; so that, after providing for their own requirements, Argentina and Australia may be in a position to export 140 million centals from their new crops.

From the foregoing estimates it follows that the quantity of wheat theoretically at the disposal of the importing countries during the commercial season, 1st August, 1925, to 31st July, 1926, will amount in the aggregate to about 470 million centals.

II.—REQUIREMENTS OF IMPORTING COUNTRIES.

Some indication of the possible requirements of the importing countries during the commercial season, 1925-26, though merely approximate, may be gathered from Table II. Here are set forth, as regards most of the importing countries, in the first place, their production, imports and apparent consumption during the last three seasons, and on the other hand their production in 1925.

The plentiful harvests of wheat (and of rye also) gathered in these countries render it certain that their import requirements must be reduced this season. If their consumption in 1925-26 is to be limited to the figures of *apparent* consumption during the season 1924-25 an import of about 265 million centals would suffice. The experiences of previous seasons, however, go to show that, during seasons of plenty, imports do not necessarily decline proportionately to the increased home production. The replenishment of stocks, so generally reduced after a poor harvest such as that of 1924, and the inclination to consume more in a season of plenty, are doubtless con-

tributory causes in such instances. It is therefore estimated that the probable imports into those countries which are taken separately in Table II., between 1st August, 1925, and 31st July, 1926, will be 310 million centals. The requirements of other importing countries must now be added, require-

TABLE II.—WHEAT (GRAIN AND FLOUR REDUCED TO EQUIVALENT IN GRAIN).

The Apparent Consumption of Importing Countries in the seasons from August 1, 1922, to July 31, 1923, August 1, 1923, to July 31, 1924, and August 1, 1924, to July 31, 1925, compared with the Production of Wheat in 1925.

(Million Centals.)

Countries.	Production in 1922.	Imports 1922–23	Apparent Consumption 1922–23.	Production in 1923.	Imports 1923–24	Apparent Consumption 1923–24.	Production in 1924.	Imports 1924–25	Apparent Consumption 1924–25.	Producton in 1925.
Germany ...	43·2	22·5	65·7	63·9	17·7	81·6	53·5	47·5	101·0	64·0
Austria ...	4·5	7·5	12·0	5·3	13·7	19·0	5·1	b 9·3	14·4	7·1
Belgium ...	6·4	23·8	30·2	8·0	24·1	32·1	7·8	b 23·2	31·0	c 8·4
Denmark ...	5·5	3·5	9·0	5·3	5·4	10·7	3·5	3·9	7·4	c 4·9
Esthonia ...	0·4	0·7	1·1	0·4	0·6	1·0	0·3	0·5	0·8	0·3
Finland ...	0·4	2·9	3·3	0·4	3·1	3·5	0·5	2·6	3·1	0·4
France ...	146·0	27·3	173·3	165·3	32·1	197·4	168·7	18·3	187·0	197·4
Gr. Britain and Ireland d	39·9	b126·3	166·2	36·3	b143·4	179·7	32·2	136·1	168·3	b 31·0
Greece ...	5·7	9·7	15·4	8·0	12·0	20·0	5·8	12·2	18·0	6·9
Italy	97·0	69·4	166·4	134·9	42·2	177·1	102·1	53·5	155·6	144·4
Latvia ...	0·6	0·7	1·3	1·0	1·1	2·1	0·9	1·2	2·1	1·2
Norway ...	0·4	4·0	4·4	0·4	3·5	3·9	0·3	3·2	3·5	0·3
Netherlands ...	3·6	14·1	17·7	3·7	15·8	19·5	2·8	15·9	18·7	3·1
Poland ...	25·5	1·3	26·8	29·8	1·5	31·3	19·5	9·6	29·1	35·1
Sweden ...	5·6	5·3	10·9	6·6	7·4	14·0	4·1	6·3	10·4	8·4
Switzerland ...	a 2·1	9·9	12·0	a 3·3	10·3	13·6	a 2·8	8·3	11·1	a 3·2
Czecho-slovakia	20·2	6·0	26·2	21·7	12·1	33·8	19·3	12·1	31·4	21·9
Japan ...	16·6	8·2	24·8	17·0	17·4	34·4	15·2	7·4	22·8	16·5
Egypt ...	22·0	4·4	26·4	24·4	4·8	29·2	20·5	5·6	26·1	21·9
Totals ...	445·6	347·5	793·1	535·7	368·2	903·9	464·9	376·7	841·6	576·4
Other countries e	...	84·5	...	...	118·9	...	...	81·9	...	...

a Inclusive of spelt and meslin. *b* Partly estimated. *c* Estimate. *d* Including the Irish Free State.

ments which were especially large in the season 1923-24 owing to particular circumstances, but may be taken ordinarily at about 80 million centals, with the anticipation of a like result for the current season.

Summarising thus, the total quantity likely to reach the importing countries during the season 1925-26 may be estimated at 390 million centals.

III.—CONCLUSIONS.

The balance sheet for the period between 1st August, 1925, and 31st July, 1926, therefore deals, on one hand, with an exportable surplus of wheat amounting to about 470 million centals, and, on the other, with the probable requirements of importing countries, forecasted at about 390 million centals. The result is that wheat supplies are more than sufficient to meet consumption requirements, and should leave a good margin in hand at the close of this season.

THE POTATO.

DIGGING THE CROP AND PREPARING IT FOR SALE.

G. N. LOWE,
Senior Potato Inspector.

Having followed carefully all the various necessary operations to secure a good crop, the question of harvesting it is a phase of the business which, unfortunately, has more often than not to be delegated to the tender mercies of the contract digger, particularly where the area is at all large.

The contract digger is most interested in filling the greatest number of bags per day, and not so concerned as to what remains in the ground, after, in numbers of cases, a more or less perfunctory "jab" with the fork at where the tubers ought to be. Consequently it is quite a common occurrence for the grower to find, after ploughing the paddock, anything up to a ton and a half per acre left behind and this, as can readily be imagined, may in some seasons represent the grower's profit.

In the South-Western areas at this particular season, when the grower is straining every nerve to get every possible ton away for export before the Potato Moth and heat cause trouble, the business of digging results in a great deal of anxiety, and the tendency is to put on as a digger anyone who can push a fork. It follows that the percentage of tubers injured and stabbed by such a digger is a great deal higher than ordinarily would be the case. Fork marked and cut potatoes are not desirable at any time or in any parcel of potatoes, but in export consignments they constitute a real danger to the successful carriage and appearance of the line at its destination.

All buyers, whether the housewife about to purchase groceries or the Sydney potato merchant at Sussex Street, are very largely influenced by the attractiveness of the goods submitted, and the potato grower generally does not realise what a close bearing the "get up" of even the prosaic potato has on the important question of its sale. Grading and uniformity generally, in size and shapeliness, enter into this side of the business very largely, whether the quantity of potatoes submitted be "round seed" or table size, either for local market or export.

Generally the stage at which to dig the winter-planted crop in the South-West is influenced by the market, and not the fitness of the tuber for table purposes, particularly earlier in the season when, naturally enough, the grower is after the high prices. Consequently the loss per acre in weight of the crop, comparing immature tubers with those even moderately ripe, is a very serious one, apart from the fact that unripe potatoes will not handle or carry successfully, and reach the end of their journey skinned, blackened, and generally unattractive looking. Such produce when arriving in the metropolitan markets has a disastrous effect on prices, and the spectacle is often presented of a fall of 30s. to £2 per day, not through over-supplies, but because of the extremely bad condition of the produce sent forward for sale.

This has, naturally, the effect of spoiling the market for consignments which come in a little later in good order, and to this may be ascribed largely the instability of the potato market for the South-West produce in the early summer.

Fortunately the Albany, Busselton, Hamel, and Benger crops grown through the summer do not suffer from this disability, and complaints are not heard of this produce as to lack of ripeness.

By all means harvest the seed immature, as this has a decidedly beneficial influence on the resultant crop; but table potatoes dug unripe are horrible things both to look at and to eat, after travelling long distances in bags and having been subjected to numerous handlings.

Although hand digging is most generally employed in this State, the machine does perfectly satisfactory work where the conditions of planting and cultivation are made suitable to its use, and a very great saving in harvesting costs follows. Obviously it is asking for trouble to expect a machine to successfully work a crop grown in land which abounds with stumps, roots, and stones, and it is just about as reasonable to expect a binder to operate well in a crop of saplings as to expect the machine digger to cope with such conditions.

Each of the machines on the market is designed to handle a "ridged" or "moulded" crop, and under these conditions does very nice work with proper attention given to the necessary adjustment as to depth and draught. Where the summer crop is grown under the "flat" or "unmoulded" system (and this is fairly general) the crop should be "ridged" just prior to digging to get over the difficulty. This loosening of the soil, moreover, considerably lightens the draught to the team.

One difficulty with machine digging, however, is that of securing labour for picking up, as men who are expert with the fork make better wages than can be obtained following the machine. The increasing costs of hand digging must soon compel the grower to use the machine for this work, particularly as correctly handled, the mechanical means of lifting the crop ensures cleaner digging than unskilled hand work, and far less injury to the tubers.

Undoubtedly in an area such as Benger Swamp, the machine will do its best work, as no roots or stumps need be feared, and the class of soil lends itself admirably to its use. In a district such as this, it appears that there is a very fine opening for an energetic man with machine diggers and the necessary staff to lift the crop at a price per bag, working on somewhat similar lines to the travelling shearing outfits operating in our sheep areas.

As the crop is dug the bags should be promptly sewn and carted out of the paddock, either to trucks or into the coolest, shadiest, place available in summer time, or into the shed at others. The foolish practice of placing haulms over the mouth of the bag is still noticeable, and certainly cannot be too strongly condemned, as undoubtedly this is a very definite source of disseminating the Potato Moth.

Finally, the grower who takes most trouble over grading and properly presenting his produce for market, has the least trouble in any season in disposing of his crop, and his stencil on the bags is usually sufficient to sell his offering at once.

LOCUSTS.

Chortoicetes terminifera (Walker).

L. J. NEWMAN, F.E.S.,
Entomologist.

During the past summer this destructive pest migrated into the Avon Valley areas. The unusual rains experienced throughout this area is February and March last resulted in the growth of a quantity of green feed in the stubble paddocks. The presence of this feed induced the locusts from the far inland areas to migrate following the feed. These appeared on the wing about March.

It is evident, by the presence of swarms of locusts experienced during the month of November, that this March swarm had found suitable egg-laying grounds, and had at least temporarily established themselves in this area. Fortunately the eggs laid in March did not hatch until October. The crops were then well advanced and did not suffer, and further, before the winged stage was reached in late November, the wheat was too dry for them to attack. The swarms which do so much damage to the crops arise from eggs laid in October; these give rise to young hoppers in August, which attack the growing crops. Later—in October—when winged, they have a very destructive habit of cutting off the wheat heads and thus causing great loss. They also eat up the natural feed. The November swarms are too late to injure the crops, but are most destructive to fruit trees, vines, lucerne, Soudan grass and any garden plants.

The appearance of these swarms is a serious matter, and demands the attention of all farmers and others interested. If they become permanently established in the areas now invaded, they may respond to the climatic conditions of their new environment, and appear as they do in the Eastern areas in August, and attack the growing crops.

With a view to their control, all concerned should make a special effort to note their egg-laying patches. These are generally bare, hard, and non-grassy ground. When located the egg-laden ground should be ploughed about 2½ inches deep and well harrowed. This will expose the eggs to the elements, birds and predatory insects. If this is not possible the hatching out of the young hoppers in August or October should be noted, and as soon as observed immediate action should be taken to poison same. In the hopper stage they are found in close army formation and are easily dealt with, but once they obtain the wings, which is the adult stage, little can be done.

A great deal of experimental work has been done by the Entomological branch testing out various methods of combating this pest. It has been found that the young hoppers can be most effectively destroyed by spraying them with Arsenite or Arsenate of Soda. Formula—Arsenite or Arsenate of Soda, 1lb.; molasses, 4 lbs.; and water 16 gallons. This is thoroughly mixed and sprayed over the young hoppers, grass and weeds. It kills by direct contact, and by coating their food with poison. As they grow older and stronger the spray strength is increased by reducing the water from 16 gallons to 12

gallons. This cannot be applied to green crops, as it burns the foliage; grass and weeds treated will recover. No stock must be permitted to feed over areas so treated for at least a period of three weeks after final spraying.

The bait found to be most effective is made as follows:—

Bran—30 lbs.

Arsenite or Arsenate of Soda, or Paris Green—1 lb.

Molasses—4 lbs.

Sufficient water to mix into a stiff mash.

This bait is distributed broadcast amongst the hoppers in the very early morning. The locusts are day feeders, and consequently after their night's fasting they readily partake of the moist bait. If applied later in the day it dries up rapidly, and is not so tempting or effective. There is no question as to the efficacy of these treatments if carried out by all concerned.

I desire most earnestly to warn all growers that unless the oft-repeated measures for the suppression of this pest are thoroughly and co-operatively put into operation, the wheat areas will witness a severe plague of locusts. To deal with this pest at the present stage of infestation will prove much cheaper and easier than when the countryside becomes generally invaded.

ROOT CROPS.

A. G. FORRESTER,
Potato Inspector.

In the growing of root vegetables, as in other crops, the habit of growth is the main guide to cultivation. As roots are deep and gross feeders, the beds must be worked to a fine tilth to a considerable depth in order to allow them to descend freely.

It is advisable to prepare the beds some time before planting. If prepared by trenching in a heavy dressing of well rotted stable manure between nine inches and 18 inches deep, and a lighter dressing from nine inches deep to the surface, an intermediate crop may be sown with advantage. After the removal of the intermediate crop, the beds should be brought to a fine tilth to a depth of nine inches without adding a further supply of stable manure. The stable manure used forms a basis of available plant food, which may be added to from time to time by the use of artificial fertilisers, which will insure a rapid and unchecked growth.

Points to be remembered are:—A checked growth means badly formed, tough and unsatisfactory roots; a badly cultivated bed means badly formed, forked, split and unsightly roots; insufficient food means stunted and tough roots; and over-supply of food in the surface soil, six inches deep, means

many pronged or forked roots; a dry bed means no growth; a wet and cold bed means no growth; the soil should be well firmed round the roots, not left loose; the soil at all times should be friable, warm, moist and well drained.

Roots will grow on all soils provided that they are friable, warm, moist and well drained.

Beets.—There are two classes of beet, the long and the round. The latter does not require the depth of soil that the former does. When growing for early markets a rapid growth is essential; therefore, in addition to the basis of well-rotted stable manure, a series of additional dressings is advisable. Blood and bone, which supplies nitrogen and phosphoric acid, two of the essential plant foods, slowly for an extended period, should be applied at or just prior to sowing the seed. Sulphate of ammonia or nitrate of soda, which supplies nitrogen in a readily available form, should be applied frequently in small quantities at regular intervals; a handful to kerosene tin of water watered in every 10 days from the time the plants first show above the ground; care must be taken not to touch the plants when applying. In sandy soils a dressing of potash is necessary for rapid and successful growing. Sow small quantities of seed at regular intervals to insure a continuous supply.

Turnips.—Same as beet.

Carrots.—Same as beet, except that the top-dressing in early stages may be less or at longer intervals.

Parsnips.—Same as beet, but the cultivation must be deeper. A smaller supply of nitrogen is required, as too much tends to coarsen the texture. If left in the ground, or stored in a cool place for the winter, the quality is improved. A frost after maturity, and before digging, improves the quality and sweetness. Sow thickly, as the parsnip seed is a poor germinator.

Radish.—A hardy and rapid grower. As hot weather tends to develop a rank growth causing tough and stringy roots, a cool moist locality is desirable in summer.

Varieties.—The best guide as to the most desirable varieties is your next door neighbour; the next best is a reliable seedsman.

Always obtain fresh seed, as seed carried over from one season to another deteriorates in germinating quality.

Fertiliser.—A good utility mixture for use at sowing is:—Blood and bone, 7lbs.; superphosphate, 1lb.; potash, 2 lbs.; sulphate of ammonia, 2lbs., used at the rate of 12lbs. to the chain. For top-dressing, a handful of sulphate of ammonia to a kerosene tin of water.

Sowing.—Sow thinly in drills about half an inch below the surface, or on the surface, and cover with fine soil and roll. Have drills about six inches apart. Thin out in drills when plants are about two inches above the ground to three or four inches; at all times keep weeds down, as they rob the plants of their food; headlands and borderlands should at all times be kept clear of weeds, as they form a harbour for insect pests. Drains, if used, should be kept clean and free running, otherwise the beds become water-logged and cold.

Cultivation is the method of making plant food in the soil available for the plant.

VITICULTURAL NOTES.

H. K. Johns,
Viticulturist.

JANUARY AND FEBRUARY.

The weather right through the season has been usually temperate, and to date very favourable to the setting and development of the grape. The health and general condition of the vines is better than it was this time last year, and vine diseases are less virulent. As these notes are written towards the end of November, weather conditions may be, during the next two months, of a nature that will bring about a recurrence of Oidium. I find that nearly all commercial growers have already safeguarded their vines by repeated applications of sulphur. In the event of rain and humid weather conditions following, applications of Flowers of Sulphur to be made. Sulphur, to be effective, must be placed in close contact with the affected part of the vine. The portion that falls on the ground is too diffuse to be effective. Applications of dry sulphur are best applied in the early morning when the dew is on the vine, or as the weather is clearing after rain, and should not be made on hot, bright days, as injury to foliage and fruit will result. Sulphuring of wine grapes should be discontinued when they are nearing the ripening stage.

Cultivation should be carried out in a thorough manner at least once in every three weeks to conserve the moisture, and should always be done immediately after rain. In the case of a newly-planted vineyard, the young vines should be gone through, and where there are any suffering from dryness, with hard soil round, or weeds growing near, they should at once be worked round. If young vines show signs of stressing, a good can of water should be included in the foregoing treatment. There is no trouble equal to that of failure, and this applies with special meaning to the vine culture. If an extra dry season continues, the grower will do well to try and meet the emergency by extra diligence in the way of cultivation, and hand attention to young vines.

A vine that gets a good start in the first growing season benefits thereby for the remainder of its existence. The foliage of the vine is the truest indication of the state of health. If this be rich green and glossy, the vine is thriving: if withering, it is probably suffering from want of moisture. Should the foliage have a yellowish tinge it needs both feed and water, although the latter condition may arise on account of the roots developing trouble which prevents them from performing their normal functions.

FEBRUARY AND MARCH.

Cellar.—Early opportunity during these months should be taken to overhaul all machinery, and all utensils should be carefully cleansed. Let cleanliness be your motto in every branch.

All manipulation of the wines should be conducted with strict attention to cleanliness. Cleanliness in this case means not only the absence of dirt, but the prevention of moulds and bacteria. All surfaces with which the wine comes in contact should be thoroughly cleaned and washed immediately after use. Racking of old wines should be completed by the end of February so as to avoid handling during wine making.

One ounce bi-sulphate of potash or a couple of fluid ounces of bi-sulphite of soda solution to each bucket of water will help to sweeten tubs, hoses, presses, etc., when washing.

VARIETIES OF APPLE TREES SUITABLE FOR COMMERCIAL ORCHARDS IN WESTERN AUSTRALIA.

GEO. W. WICKENS,
Officer in Charge Fruit Industry.

Fortunately Western Australian apple orchards, which are practically in their infancy, when compared with the old established places in the Eastern States, have benefited to some extent from the knowledge gained of mistakes made in the varieties chosen for planting during the early period of the fruit industry in Australia, and many varieties now obsolete, which are still to be found in orchards planted from 25 to 40 years ago, have never found space in Western Australia.

But in our plantations, 15 to 20 years of age, there are a number of unsuitable kinds which require to be worked over to up-to-date sorts, and some of the newer growers have a tendency, even at this late day, to plant varieties which have doubtful reputations as revenue producers, and to make a further mistake of carrying too many kinds even of those that are known to be good.

For a commercial apple orchard in Western Australia, no matter whether the size is 10 acres or 100 acres, six varieties are sufficient, and those I favour as being most suitable to the conditions obtaining in our principal apple growing districts are:—Jonathan, Cleopatra, Dunn's Favourite, Granny Smith, Yates, and Tasma.

With these, both the local and overseas markets can be supplied throughout the season with excellent quality fruit, and each variety named is known to be a good cropper. The first four are the main varieties for export to London and European markets, and the last two, which are somewhat late in ripening for regular shipments each season to the other side of the world, are suited to the Singapore and Java trade. With reference to these late sorts I have said "regular shipments," because there are seasons when the early English fruits are short or late in ripening, and then these can be profitably exported to London.

All six varieties are excellent for local market requirements, and I have not advised an earlier ripening kind than Jonathan because, although there are many of them, I know of none I would recommend for planting in a commercial orchard.

Jonathan does not usually realise as good a price on the London market as Cleopatra and Dunn's Favourite, but it is a payable export variety for all that; is a regular cropper, and while it is in season it practically monopolises the local market as a dessert apple. Although it appears to the uninitiated to ripen fit for shipment before Cleopatra, this is not so. Cleopatra is a better variety for the early boats than Jonathan, for the latter when picked in an immature condition never ripens properly, and has a most uninviting appearance.

Another thing to guard against in shipping Jonathans is to avoid sending them on late boats, unless they are what is known in the trade as "second" crops, which are products of late blooms, and are usually small, hard and of exceptionally high colour. The dates of ripening of the main

crop vary according to the climatic variations of the seasons, so no hard and fast date for picking can be given which would apply in every year; but, as a general rule, picking Jonathans for export should commence about the end of the first week in March and finish at the end of that month.

Cleopatras and Dunn's Favourite can be shipped in March and April: Granny Smith towards the end of April and May: Yates and Tasmas in May, and as long afterwards as the market can take them at a payable price.

Not all of the six varieties mentioned have the same robust growth. The best situations should be reserved for Yates and Jonathans, and as these are suitable for cross-pollination, they should be planted out alternately two rows of each. Yates needs hard pruning, and the fruit must also be thinned, or, as the tree ages, the apples will become so small as to be unmarketable. If a prospective planter feels he cannot depend upon having these two necessary operations carried out, then I strongly advise him to drop Yates from the list, and be content with Granny Smith and Tasma for late sorts.

I know in the above list I have omitted many varieties which are thought of most highly, both by growers and consumers; and when one considers there are not merely hundreds, but thousands, of varieties of apples in existence to select from, it would be strange indeed if there were not many excellent sorts amongst them.

But I am giving my own opinion that under Western Australian conditions the six mentioned will give the greatest satisfaction.

I can hear readers say:—"What about Delicious, Statesmen, Dougherty, Sturmer, Rokewood, Nickajack, Cox's, etc." Well, I can only reply I know these and many other good sorts very well indeed, and I make my choice after a long experience and close observation of apple growing in Western Australia. The only one in my list which has not had a long trial in this State is Tasma, but I have watched it now for eight years, and am satisfied it is good.

With reference to Cox's Orange Pippin, I am sorry that in spite of advice given by the officers of this Department for many years past to avoid planting the variety, there are still some of the newer growers who are attracted by the high prices obtained for it in England, and who are planting it in spite of warning.

It has never been a commercial success in this State. I doubt very much if it has in the Eastern States, but until just lately I understood it certainly was a commercially successful apple to grow in England. Apparently, however, even that is not correct, *vide* the following, taken from Sectional Volume, No. 4, page 69, published by the Ministry of Agriculture and Fisheries, England, dated 1921:—

"*Cox's Orange Pippin.*—A dessert apple of the best quality. Size, medium to small. Round, orange, shaded and striped with dull red. Carries well. A very unreliable cropper, and only a moderate grower of somewhat spreading habit. Should be grown as either bush or cordon on dwarfing stocks. Very subject to scab, mildew and canker, especially on heavy cold soils. Seems to succeed best on gravelly soils. As a commercial variety is a speculation."

THE ANNUAL BIRDSFOOT TREFOILS.

(*Lotus angustissimus and L. hispidus.*)

W. M. Carne, F.L.S., C. A. Gardner and A. B. Adams.

Two annual birdsfoot trefoils have become established in the South-Western portion of the State.

Lotus hispidus is known in New Zealand and Eastern Australia as the Hairy Birdsfoot Trefoil or Boyd's Clover. *Lotus angustissimus,* or Slender Birdsfoot Trefoil, is known in this State as Manjimup Clover or Giblett's Grass. The use of the technical Latin names is advised. Local names vary in different districts and lead to confusion, especially when it is realised that seedsmen have usually to purchase their seed stocks in countries where these names are unknown. The seed of the two plants under consideration comes mainly from New Zealand. Both plants there grow together, and the seed is consequently a mixture of both species. Commercially both plants are regarded as the same and are sold under either name.

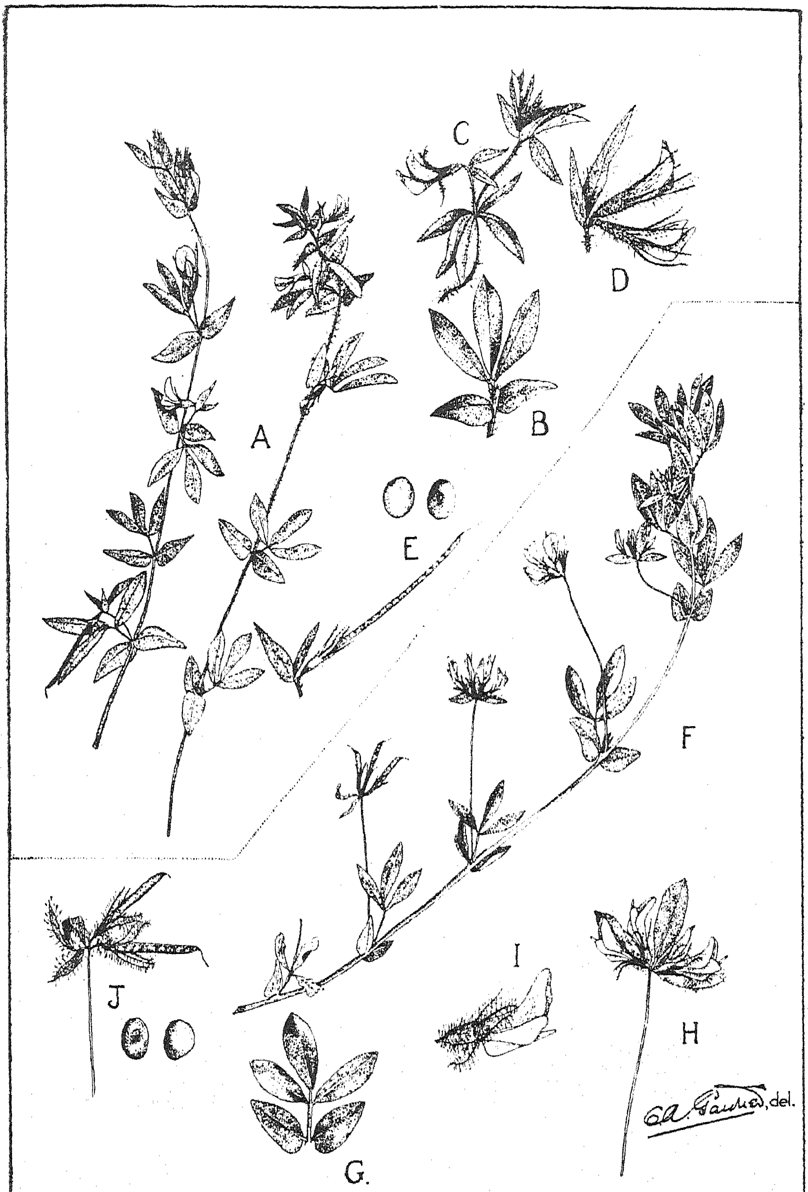
Lotus angustissimus is well established in the Manjimup area, and on the heavier soils in the Bunbury district, and as far East as Kulikup. It germinates with the first winter rains, but makes very little growth until the Spring. It is much later than Subterranean or other annual clovers, making rapid growth during November and remaining green until after Christmas when properly controlled. If allowed to run to seed without stocking, or if top-dressing with superphosphate is neglected, it will dry off much earlier. When well established and top-dressed it has a high stock carrying capacity, and a good reputation as a fattening feed. Unlike many of the legumes, it is not reputed to taint milk or cream.

For sowing on good swamps it is not recommended, though it will do well, because *Lotus major*, *L. corniculatus* and other perennial plants will usually give a better return. It is recommended for heavy wet land, which becomes dry in the summer. It prefers heavy soils such as clay, or ironstone gravel. On loose dry sands it is not a success. Sown with Subterranean Clover it should do particularly well, as it comes into vigorous growth as the former goes to seed. Given early rains this mixture should give fair grazing in the winter, and a fattening paddock from the middle of September until Christmas or later.

Though eaten readily when young, stock do not appear to care for it when in flower, and this enables it to seed prolifically. When in seed, and dry, stock take to it again, and thus help to distribute the seed.

To establish this plant it should be sown fairly thickly, say, 3 lbs. to the acre, with a dressing of 2 cwt. of super. This area should be regarded as a seed patch, the seed being swept up when ripe and sown in other paddocks. The seed is very small and readily shed so that stock leave the greater proportion behind. Nevertheless they do help to spread it.

There is always a large proportion of seed which, though quite sound, is unable to germinate until the seed-coats have received some injury. These are known as hard seeds, and their germination is greatly increased by a fire. The grower must, therefore, be prepared for a poor germination the first season, but, given reasonable care, the proportion of plants present will increase annually, even very rapidly if a fire should go through the paddock. On bush country it should be sown after a burn.



Lotus angustissimus, Linn, and *Lotus hispidus*, Desf.

L. angustissimus (A—E):
A.—Portion of stem.
B.—Leaf.
C.—Inflorescence.
D.—Flowers.
E.—Pod and seed (seed enlarged).

L. hispidus (F—J):
F.—Portion of a stem.
G.—Leaf
H.—Inflorescence.
I.—Flower.
J.—Pods and seed (seed enlarged).

Lotus angustissimus makes a most marked response to top-dressing. At Bunbury on a trial plot on good soil an area top-dressed at the rate of 2 cwt. of super. per acre yielded at the rate of 16 tons of green feed, or 4 tons dry per acre. It does well on uncultivated soil, which has been top-dressed after a fire, while on unmanured land it frequently grows only a few inches high.

Lotus hispidus resembles closely, and is often confused with, *L. angustissimus.* It is a stronger grower in suitable situations, with broader leaves. It is also later, and may keep green a month longer. So far it is not as widely distributed as *L. angustissimus,* though both may be found growing together. In treatment recommended and in other respects the two plants are similar.

It should be remembered that purchased seed is usually a mixture, with one or other of the two plants predominating.

The seeds of both are very small and run about 500,000 to the pound. Samples, however, invariably contain other seeds such as Flat Weed, Rib-grass, Hair-grass, Silver-grass, Yorkshire Fog and annual clovers, docks and sorrel, representing about 3 per cent. by weight. Of the sound seed we find the germination is about 30-40 per cent.; the hard seeds representing 40-50 per cent.

Description.—From the other herbaceous leguminous fodder plants Lotus may be distinguished as follows:—

The leaflets are five in number, the three uppermost spreading clover-like from a short stalk, the two lower ones (unequal-sided) at the base of the stalk, and resembling leafy stipules. The stamens are ten in number, the five alternate filaments being widened towards the anther. Only the upper stamen is free. The pod, which is cylindrical, is longer than the calyx, and has membranous partitions between the seeds.

There are four species of *Lotus* cultivated in Western Australia besides one indigenous one. The two *annual* species may be contrasted as follows:—

Peduncles short and slender, usually 2-flowered, pod 1-1¼ ins. long, seeds not speckled—*L. angustissimus.*

Peduncles rather long, flowers usually 3-4, pod ½-¾ ins. long, seeds speckled—*L. hispidus.*

Lotus angustissimus.

An annual prostrate or ascending herb with soft hairs on all its parts, especially around the flowers and young leaves; leaflets usually narrow, the two lowest ones broader and unequal-sided, the three uppermost on a short stalk. Flower stalks (peduncles) short and slender, usually 2-flowered, sometimes 3-flowered, the flowers pale yellow, the standard usually broader than long, fading to a greenish colour. Pod long and narrow, 1-1¼ ins. long. Seeds about 0.9 mm. long, almost rounded; the face slightly less convex than the edges; the surface smooth, uniformly yellow, or purplish-yellow to purple, not speckled.

Lotus hispidus.

An annual, erect or ascending herb usually more hairy and stouter than the preceding, with longer stouter flower-stalks. Flowers usually four, sometimes three, the standard usually longer than broad; not fading to a green colour,

usually a deeper yellow than the preceding. Pod ½-¾ inches long, rather thick. Seeds usually 1.1mm. long, almost round, the faces slightly less convex than the edges; surface usually speckled, smooth, with a fairly bright gloss, greenish-yellow, purplish-green to dark purple in colour, the speckles dark purple. The amount of speckling appears to be a varietal characteristic. Brown unspeckled seeds of this species may occur when the samples have been cut before maturity.

THE DESTRUCTION OF STAR THISTLE BY ARSENATE OF SODA.

David L. Breen,
Orchard Inspector.

A common method of destroying "Saffron Star Thistle" is to cut the plants with a hoe or scythe, or with a mowing machine when large areas have to be dealt with.

As a considerable area affected with this pest had to be destroyed in the Murray district and upon which, owing to the broken and stony nature of the country, it was not possible to use either a scythe or a mowing machine, it was decided to ascertain the effect of solutions of Arsenate of Soda of varying strength upon the vitality of this weed.

For the purpose of these trials eight lots of land, each 33 feet by 33 feet, were selected as being uniformly and well covered with Saffron Star Thistle (*Kentrophyllum lanatum*). The thistles on these plots were of different stages of maturity, and ranged in height from six inches to six feet.

The plots were sprayed with solutions of Arsenate of Soda, as hereunder:—

Nos. 1 and 5—Arsenate of Soda, 1lb. to 4 gallons of water.
Nos. 2 and 6—Arsenate of Soda, 1lb. to 8 gallons of water.
Nos. 3 and 7—Arsenate of Soda, 1lb. to 12 gallons of water.
Nos. 4 and 8—Arsenate of Soda, 1lb. to 16 gallons of water.

The spraying was done with a hand pump on 28th October, 1925, and the same quantity, about 10 gallons, was distributed on each plot. On October 30th the Star Thistles on Plots 1 and 5, which had received the strongest solutions were all dead, and on November 3rd when the next examination was made, the thistles, grass, and wattle and other scrub in all the plots were dead and so completely dried up that the whole area could have readily burned.

Judging by the result of this experiment it is quite practicable to check and destroy this pest by spraying with solutions of Arsenate of Soda, made by mixing 1lb. with 16 gallons of water, and further experiments may show that a weaker solution will be effective. Even with the whole area as thickly infested with Star Thistles as were the trial plots—a most unlikely contingency—the cost of the material for spraying an acre would range from 20s. to 25s.

Some thistles adjoining Plot 4, on which the weakest solution was used, received a light spraying owing to the effect of the wind, and were partially killed; it is therefore possible that a smaller quantity of solution than that used in the trials, viz., 400 gallons per acre, would prove effective. It is estimated that with proper equipment two men could spray one acre per day.

FOREST INSECTS.

THE MARRI BORER (*TRYPHOCHARIA HAMATA*).

J. Clark, F.L.S.,
Assistant Economic Entomologist.

This beetle belongs to the large family *Cerambycidae*, the members of which are generally known as longicorns or long-horned borers. The present example is typical of the group to which it belongs, although superficially it closely resembles the species of the allied genus *Phoracantha*. The habits of the two groups are quite different. The species of *Tryphocharia* usually breed in living trees, whilst the *Phoracantha* in general prefer dying or dead timber, and are regarded as secondary borers. The larva of the *Phoracantha* eats its way through the sap wood in all directions, making the peculiar scroll-like markings generally found under the bark of dead trees. When nearly full grown it bores for a short distance into the hard wood, where it makes a small chamber and therein pupates.

The larva of *Tryphocharia* lives only for a short time in the sap wood, most of its life being spent in the hard wood in the interior of the tree.

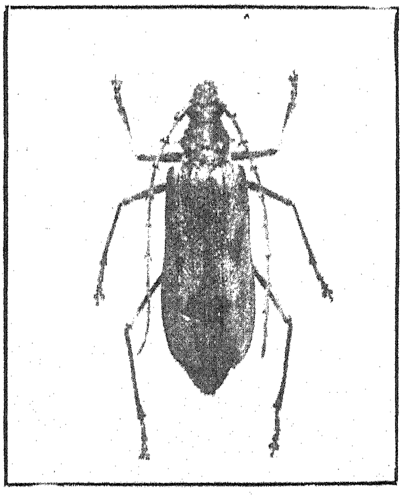


Fig. 1. (Original.)
Tryphocharia hamata (Newm.).
Female, natural size.

The female (Fig. 1) is a handsome beetle, measuring from 1½ to 2 inches in length. The wing covers are yellow; sometimes reddish yellow, with an irregular transverse brown band just in front of the middle, and an irregular blotch of the same colour behind the middle; the tips of the wing covers are always light yellow. The front part of the wing covers is deeply and coarsely punctured or pitted. These punctures become finer towards the tips which are almost smooth and shining. The tips of the wing covers are nearly straight across, not rounded, and are armed with four sharp spines. The two spines in the middle are longer and thinner than those on the outside. The thorax is reddish brown and very coarsely pitted on the top. There are

two large bluntly rounded tubercules, one on each side, behind. On each side at the middle there is a long, sharp spine, which is abruptly hooked backward at the point. The antennae do not quite reach to the tip of the wing covers; they have 11 joints; the first is large and club shaped; the second very short, and the remaining nine are about equal in length. The joints, three to eight, are armed with a sharp spine on each side at the apex. These spines are longest on the inside, on the third, fourth, and fifth joints than those on the outside; on the sixth joint both spines are equal in size; on the seventh and eighth they are longest on the outside. The antennae of *Phoracantha* have these spines only on the inside of the joints.

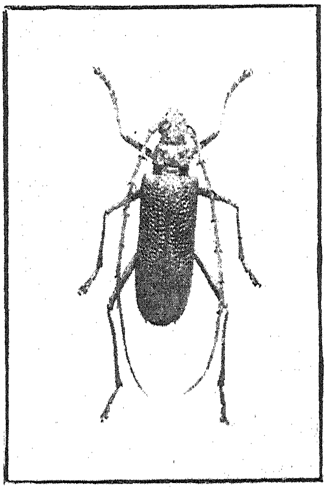


Fig. 2. (Original.)
Tryphocharia hamata (Newm.).
Male, natural size.

The male (Fig. 2) is smaller than the female, but the antennae are much longer. Otherwise they are very similar.

This beetle is found throughout the South-West from Perth to Albany. The males and females may be found flying early in the evening, at dusk, during January and February. During the day they are sometimes to be seen under loose bark on tree trunks. It attacks various Eucalypts, but appears to have a preference for Marri (*Euc. calophylla*). Other trees attacked are Tuart (*Euc. gomphocephala*), Blackbutt (*Euc. patens*), Wandoo (*Euc. redunca, Var. elata*), Red Flowering Gum (*Euc. ficifolia*), Red Tingle (*Euc. jacksoni*). Trees in all stages of growth are attacked, but for preference, young trees about a foot in diameter.

The eggs are elongate oval, almost cylindrical; they are greenish white in colour, and about one quarter of an inch long. They are of a very soft gelatinous nature, with a soft pliable skin or covering. They break at the slightest touch. When deposited by the female in the small cracks of the bark, these eggs are coated with a gummy substance which makes them adhere. On hatching from the egg the larva eats its way through the bark in a spiral direction, gradually working into the sap wood, through which it bores until strong enough to penetrate the hard wood. By the time the larva starts to bore up through the solid trunk it is about 1½ inches long. From this point it bores its way upward in a very erratic course; at times boring into the sap wood at various sides of the tree. The larva continues to bore

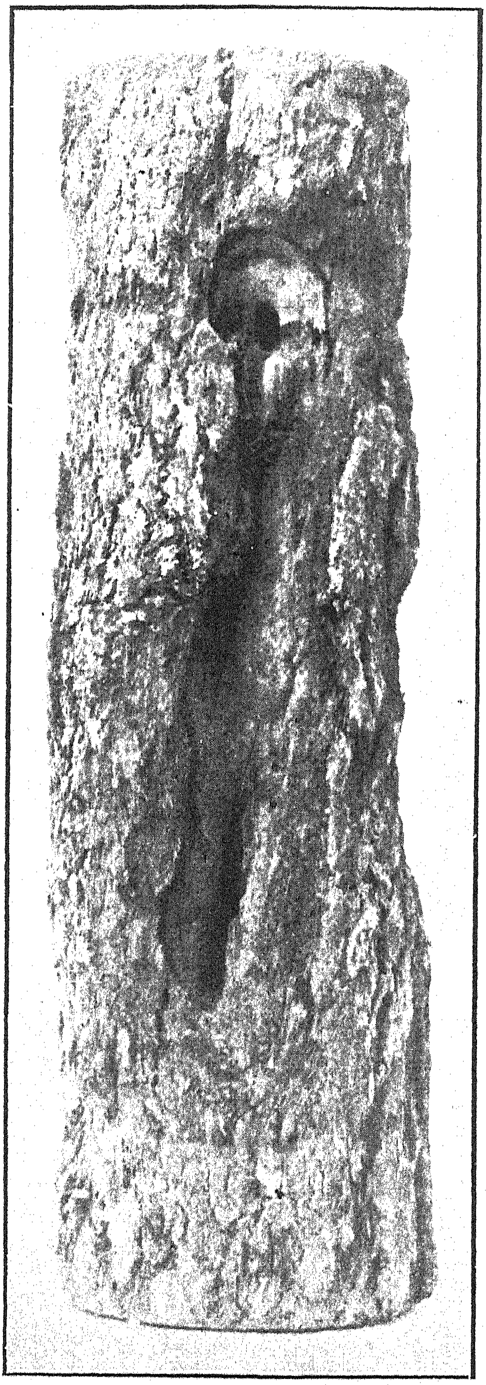


Fig. 3. (Original.)
Portion of Marri sapling showing typical boring and ear-like wound made by the larva, or grub. Also the exit hole from which the adult beetle has issued.

upwards to from eight to 12 feet before it is full grown. At this stage it bores completely through the sap wood and sometimes through the bark, and excavates a broad channel about 18 inches long between the hard wood and the bark, completely cutting away the sap wood. At the top of this groove it cuts the peculiar typical "ear-shaped" mark (Fig. 3), in the centre of which it again bores into the hard wood, but this time in a downward direction for a distance of nine to 12 inches, forming a large pupal chamber. While forming this chamber the material is packed hard behind the larva, with the result that the entrance is solidly plugged.

The pupal chamber is made during April and May, but the larva, although lying in the chamber does not pupate until October or November. The beetle issues during December and January. The period passed by the larva in the tree is two years. For some reason, at present unexplained, the larva sometimes make what appears to be a dummy pupal chamber, usually

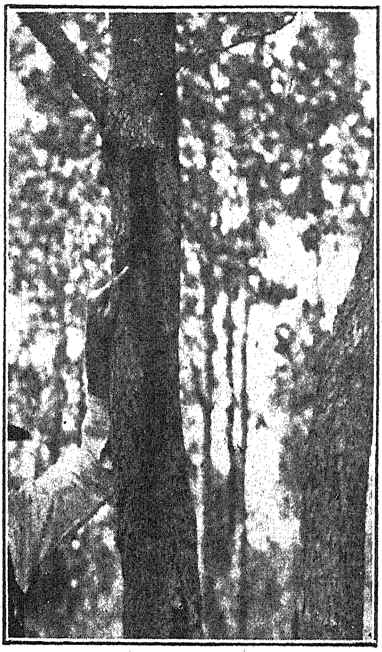


Fig. 4. (Original.)
Marri sapling showing both true (lower) and dummy (upper) entrance to pupal chamber.

only a few inches from the entrance to the true chamber (Fig. 4). This dummy is never occupied. The pual chamber is generally about 15 feet up from the ground, frequently much higher. A number of trees containing these borers were kept under observation, and traps were attached as soon as the pupal chamber was made. These traps consisted of fine fly wire gauze nailed over the exit of the chamber (Fig. 5). To reach these a ladder was made by cutting notches in a sapling as in the photograph. A dozen traps were placed in one area, Mundaring Weir, each of these contained a beetle with no traces of parasites, which is surprising, as the larva is practically exposed during the period when it is boring between the bark and the sapwood.

Many larvae fall victims to parasites when they bore into the sap wood during their erratic course upward. In numerous cases the work stops at this spot, and only the remains of the larval skins are to be found. Several *Braconid* wasps may be seen around borer infested trees, but so far none

Fig. 5. (Original.)
Young Marri trees. Arrows indicate the traps attached over exit from pupal chamber.

have been reared from larvae or pupae. Black cockatoos (*Calyptorhynchus* sp.) frequently tear the bark off in their efforts to get the larvae, but from general appearances it does not seem as though they get many of them. The destruction caused by this bird is almost as bad as that done by the borer, as it frequently completes the damage by girdling the tree.

It has been recorded that this borer is the main cause of kino, or red-gum, and of gum-veins in Marri. Such, however, is not the case. Whatever the cause of kino and gum-veins may be, insects play very little, if any, part in their formation. Many trees badly affected with gum-veins have been proved after careful examination to contain no traces of borers. On the other hand Marri trees with *Tryphocharia* borers have been found entirely free from kino and from gum-veins. When the borer strikes a gum-vein the burrow fills up with the kino, and the larva is destroyed. These burrows frequently act as reservoirs for kino.

EXTRACTS FROM REGULATIONS UNDER "THE STOCK DISEASES ACT, 1895," FOR THE GUIDANCE OF SHEEP OWNERS.

COMPULSORY DIPPING AREA.

South-West Division of the State South of the Eastern Railway.

32. (a) Every owner of sheep within the boundaries of that part of the South-West Division South of the Eastern Railway shall after the shearing of such sheep and before the 30th day of April in each year, dip or cause to be dipped, in a swim bath prepared with some specific known to be fatal to ticks and lice, all sheep running on land whereof he is the owner or occupier.

(c) For every sheep not dipped as provided in this regulation, within the period prescribed above, the owner shall be liable to a fine not exceeding two shillings.

South-West Division of the State North of the Eastern Railway.

32. (b) Every owner of sheep within the boundaries of that part of the South-West Division North of the Eastern Railway shall, after the shearing of such sheep and before the 28th February in each year, dip or cause to be dipped, in a swim bath prepared with some specific known to be fatal to ticks and lice, all sheep running on land whereof he is the owner or occupier.

Ewes with lambs—time for dipping.

33. Notwithstanding anything contained in these regulations, it shall not be necessary to dip ewes affected with ticks or lice during such time previous to or after their lambing as the inspectors may appoint, and for such purpose any inspector may, in respect of such ewes, extend any notice to dip for such time as he shall think fit.

Statutory Declaration to be supplied within seven days after dipping.

34. Within seven days after the dipping of his sheep the owner shall make a statutory declaration before a justice of the peace, to the effect of Schedule 5a hereto, stating that he has dipped his sheep in accordance with the provisions of these regulations, the date of dipping, the number of sheep dipped, and the class of dip used, and he shall forward such declaration to the police officer in charge of the police station nearest to him. Such declaration shall be forwarded by the said police officer to the Chief Inspector of Stock.

Note.—It is essential that the following information be shown on the declaration:—

1. The Road Board District in which the holding is situated where the sheep are held.

2. The strength at which the dip is used, *i.e.*, number of packets to the number of gallons. The information "according to directions on packet" is not sufficient.

Permits to move sheep in the Gascoyne.

Every owner of sheep in the area defined in the Schedule hereto must, before travelling or removing or causing to be removed, or attempting to remove, any sheep to any place outside the said area, obtain a permit to remove such sheep from an inspector of stock, who shall not issue the said permit unless he is satisfied that the sheep intended to be so removed out of the prescribed area are free from parasites known as tick and lice; and every person contravening this regulation by act or omission shall be punishable summarily, and upon conviction be liable to a penalty not exceeding one hundred pounds and not less than fifty pounds.

Schedule.

That portion of the State bounded on the South by the Northern boundary of the South-West Division, commencing at the sea-coast and proceeding as far as the intersection of such boundary with the 115.5 meridian of longitude; thence following such meridian Northerly to the intersection of the sea-coast; thence along the sea-coast to the starting point.

Lice or tick-infested sheep in any part of the State.

36. (a) If an inspector is satisfied that a flock depasturing in any part of the State is affected with tick or lice, he shall give the owner thereof notice to dip such stock forthwith to the satisfaction of the inspector or his agent.

Provided that the owner who refuses, neglects, or fails to comply with such notice on or before the date specified therein shall be liable on conviction to a penalty not exceeding fifty pounds for the first offence, and if immediately after conviction for the first offence such sheep shall not be dipped to the entire satisfaction of the inspector, such owner shall upon conviction be liable to a further penalty not exceeding fifty pounds, and so on for each and every succeeding conviction.

Tick or lice on sheep exposed in a public market or exhibited for show purposes or any other place where offered for sale.

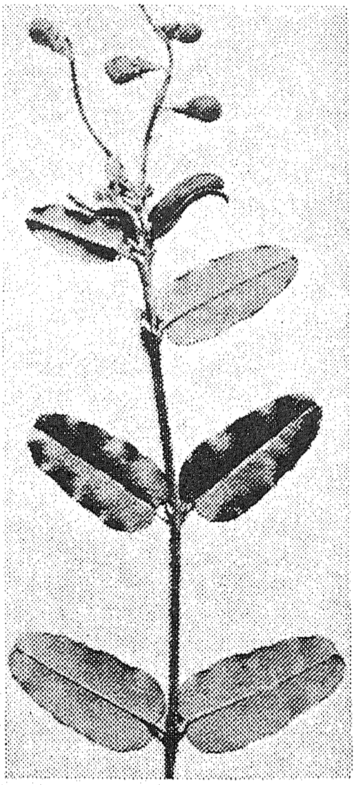
36. (b) If any sheep affected with tick or lice shall be found in any pound, or in any yard or yards, or on any land or other place at which sheep are offered for sale or exhibited for show purposes, the owner exposing the sheep so affected shall be liable to a penalty not exceeding fifty pounds: Provided that any inspector, if he deems it necessary, may order the withdrawal from sale of any sheep affected with ticks or lice until such sheep have been dipped or dressed to the satisfaction of such inspector or any other inspector, and shall give notice to the aforesaid owner of such sheep to dip or dress the same forthwith, at such place as the inspector may direct; and every such owner who refuses, neglects, or fails to comply with the aforesaid notice is liable to a further penalty not exceeding twenty pounds. But if the inspector is satisfied that such sheep are intended for immediate slaughter, he may withhold such notice to dip.

A SERIOUS MORTALITY IN SHEEP.

(Ascribed to poisoning with *Gastrolobium villosum*, "Crinkly Leaf Poison.)

H. W. BENNETTS, M.V.Sc.,
Veterinary Pathologist.

Recently heavy losses in sheep on a property at Lower Chittering were reported to this Department. An investigation was made, and it was ascertained that the owner had lost 157 out of a total of 180 sheep, purchased about a month previously. This almost complete decimation of the flock took place in three or four days.



Crinkly Leaf Poison.

A *post mortem* examination of two wethers gave indications of the trouble being due to ingestion of poison plants, viz., gastro-enteritis and congestion of the lungs, liver, and kidneys. This theory was strongly supported by the history, especially the sudden and severe mortality.

Crinkly Leaf poison, apparently the only poison plant on the property, was present in abundance and was in the flowering stage. Specimens were identified by the Government Botanist. This plant is known to be a bad poison, and is stated by Herbert to be "poisonous at all periods of its growth, but especially so when flowering or fruiting."

It is interesting to note, which strongly incriminates it as being the cause of the present trouble, that this plant was reported by Dr. Morrison in 1899 as having caused the death of 400 sheep in one day; also in this same district.

I undertook feeding experiments on guinea pigs with samples of the plant from Lower Chittering. The plant was minced up finely, mixed with bran, moistened with water and fed to guinea pigs. The results of these experiments were negative. It appears that guinea pigs are not very susceptible to the effects of this and some other native plants which are known to be poisonous.

IT PAYS TO SKIRT THE FLEECE PROPERLY.

The illustration herewith represents the burry part of a fleece found in a bale of otherwise super wool displayed on the show floor for the Perth wool sales last November.

This fleece and a very few others in this "lot" were the only ones from which the whole of the burry portions had not been skirted. The presence

The burry portion of an improperly skirted fleece.

of the burry skirtings obviously reduced the value of the fleeces on which they were left, but what is not so obvious to the grower is that their pre-

sence also reduced the value of the whole of the wool in the line of eighteen bales, of which that in the five show bales was representative. Further, the finding of the burry portion compelled the American buyer, who was examining and valuing this "lot," to cease valuing it at once, as the American requirements demanded that only wool free from burrs and other vegetable matter be purchased.

Valuable competition for an otherwise suitable line was thus lost, with the result that the price realised was 22d. instead of a possible 25½d. per lb. This instance most emphatically demonstrates that the benefits of "skirting" are lost if it be not done properly.

If the competition of the American and the best British and Continental buyers is desired, it is not sufficient to remove portion of the skirting; all the burry and dissmilar skirtings must be removed from the clean and main portion of the fleece wool. Each class or description will then be available to the buyer for whom it is suitable, secure the greatest competition, and sell at the highest rates. (The Director of Agriculture.)

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF SEPTEMBER, OCTOBER AND NOVEMBER, 1925.

—	SEPTEMBER.					OCTOBER.				NOVEMBER.			
	2.	9.	16.	23.	30.	6.	14.	21.	28.	4.	11.	18.	25.
Sheep and Lambs	8,251	10,536	9,401	9,941	12,576	9,567	12,415	15,100	19,514	13,202	15,083	14,129	19,785
Cattle ...	870	719	989	851	791	635	588	992	774	884	908	755	721
Pigs ...	753	789	773	750	655	432	861	814	731	503	733	516	296

COMPARATIVE VALUES OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF SEPTEMBER, OCTOBER AND NOVEMBER, 1925.

—	SEPTEMBER.					OCTOBER.				NOVEMBER.			
	2.	9.	16.	23.	30.	6.	14.	21.	28.	4.	11.	18.	25.
Mutton	11	10¾	10½	10¼	10¼	W 10¼ OS 5½	W 10¼ OS 5½	OS 5½	OS 6	OS 6½	OS 6¼	OS 5½	OS 5¾
Beef ...	6	5¼	5½	5½	5½	5¾	5¾	5½	5¼	5½	5¼	5	5
Pork ...	11¼	11¼	10½	10	10¼	10½	10¾	10	9¾	10	8¾	8¾	8¾
Bacon ...	10	10	10¼	10¼	10¼	11	10¼	9¼	9	9½	8½	8½	8½

NOTE.—W—in wool; OS—off shears.

MARKET REPORT.

The following particulars of the approximate quantity of chaff available for auction at the Metropolitan Chaff and Grain Auction Sales held in Perth during the months of September, October, and November, 1925, also the minimum and maximum prices ruling for f.a.q. to prime quality during those months, have been supplied by Messrs. H. J. Wigmore & Co., Limited, of Wellington Street, Perth, and will be valuable for reference:—

Wheaten Chaff—

September: Quantity—1,850 tons.
Maximum price—£7 15s. per ton.
Minimum price—£6 7s. 6d. per ton.

October: Quantity—1,800 tons.
Maximum price—£7 per ton.
Minimum price—£6 5s. per ton.

November: Quantity—2,300 tons.
Maximum price—£6 2s. 6d. per ton.
Minimum price—£5 5s. per ton.

The £7 15s. per ton, shown as the maximum price in September, was the top price for the season, and was secured for a truck or two only at the beginning of September, when owing to the dry spell then being experienced, buyers were anxious and inclined to speculate. However, after falls of rain, holders were eager to quit, and the market generally receded. The first new season's chaff arrived in the market on the 28th of October, but for a week or two the sample was insufficiently cured. However, during the last half of November the quality arriving was all that could be desired, and with trucks plentiful, and practically all chaff-cutting plants working, the market was for a few days glutted, and values fell to £5 5s. However, evidently farmers were not prepared to market at this figure, and with shorter supplies arriving, the market recovered and at the time of writing, 10th December, 1925, is steady at £5 15s. per ton.

Oaten Chaff.—Supplies of this at any stage during the three months mentioned above were not heavy. Of course prices were influenced by the prices ruling for wheaten. Very little oaten chaff was marketed during November, and for a day or two the supplies were so short that several consignments of oaten chaff realised prices higher than prime wheaten. At the time of writing supplies are not adequate to meet the demand, and consignments arriving should meet a satisfactory market.

Oats.—Prices ruling during the last three months have been considerably better. This is accounted for chiefly by the dry spell in Victoria, causing Melbourne buyers to operate on this market, and during the first half of November good clean heavy Algerian oats, packed in bags fit for shipment, were realising from 2s. 11d. to 3s. 1d. per bushel. An immediate shortage was not the cause of Victorian operations, but we think that the crop prospects in that State resulted in merchants speculating. However, after a

fine fall of rain in the Victorian oat districts, which it is understood will benefit the oat crops, buyers entirely withdrew. During the course of the last few days Victoria has been again inquiring, but their indications of value are rather too low to permit of business being done. While writing, we would mention that merchants in the Eastern States will accept only good clean heavy feed Algerians, and, furthermore, they must be packed in good sound bags in accordance with the law in Victoria, which prohibits the use of super. bags for packing oats. While very little business is being done at present with Victoria for future requirements, a few merchants in Perth still have contracts to fill for sales made a few weeks ago, and good clean heavy feed Algerians packed in good bags are realising from 2s. 9d. to 2s. 9½d. on the Perth market. Good heavy feed Lachlans are selling at around 2s. 8d., but light feeds and others, such as Burt's Early, Rua Kura, etc., are in poor demand, and are selling at from 2s. 1d. to 2s. 5d. per bushel, inferior realising lower rates. From present indications we believe that good clean heavy feed Algerians, packed as mentioned above, would meet with a satisfactory market.

Wheat.—At the time of writing, the market is firm, and supplies arriving in Perth are extremely scarce. F.a.q. is worth 6s. 6d. to 6s. 7d. per bushel.

Barley.—A few consignments of new season's Cape have arrived during the last few days, but the market is dull, and consignments have been quitted at from 3s. 2d. to 3s. 3d. per bushel.

METEOROLOGICAL INFORMATION.

1925.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
SEPTEMBER, 1925.					inches.	inches.
Chapman State Farm	71·4	90·7	47·7	40·1	2·42	1·61
Geraldton	72·2	84·0	52·4	40·4	1·97	1·37
Walebing	68·3	84·2	42·8	34·0	4·39	2·17
Perth	68·4	81·2	49·1	40·1	3·54	3·40
Kalamunda	67·8	79·0	48·5	39·0	4·68	4·63
Bunbury	67·3	77·8	50·1	41·2	4·75	5·70
Bridgetown	67·1	81·5	40·4	29·9	4·08	3·85
Albany	64·1	78·6	48·3	38·0	3·16	4·04
Merredin State Farm	...	...	40·0	30·2	0·98	0·96
Northam	69·1	81·9	43·3	34·3	2·36	1·65
York	70·2	83·0	41·3	33·0	1·72	1·65
Narrogin State Farm	66·5	79·0	41·4	32·7	1·55	2·36
Katanning	65·6	80·4	41·6	32·0	2·72	1·96
Cape Leeuwin ...	65·7	73·5	53·0	47·0	3·86	3·16
OCTOBER, 1925.					inches.	inches.
Chapman State Farm	72·6	85·5	48·8	42·5	0·82	0·95
Geraldton	70·6	...	54·4	45·0	0·86	0·71
Walebing	70·0	90·2	45·4	35·1	1·18	1·32
Perth	67·2	88·1	51·0	42·1	2·18	2·18
Kalamunda	69·8	85·0	50·0	38·6	2·95	3·31
Bunbury	67·0	85·8	52·8	42·4	2·46	2·46
Bridgetown	64·8	81·0	44·3	35·2	3·45	3·00
Albany	62·7	74·0	49·7	42·4	3·90	3·26
Merredin State Farm	...	...	45·0	35·7	0·53	0·59
Northam	69·6	92·8	47·3	38·3	0·50	1·00
York	71·3	89·0	45·8	37·0	0·63	1·05
Narrogin State Farm	68·4	85·0	43·0	33·6	1·71	1·43
Katanning	64·9	80·0	44·4	37·0	2·60	1·54
Cape Leeuwin ...	63·3	71·0	53·7	46·0	2·46	2·85
NOVEMBER, 1925.					inches.	inches.
Chapman State Farm	87·9	107·4	60·0	46·4	0·26	0·21
Geraldton	82·6	107·0	62·9	53·3	0·22	0·25
Walebing	86·3	100·5	56·7	45·0	0·42	0·52
Perth	80·2	102·1	59·1	51·1	0·23	0·80
Kalamunda	81·6	102·4	57·3	48·5	0·07	1·14
Bunbury	79·0	100·0	56·0	44·2	0·34	1·06
Bridgetown	80·7	102·0	49·3	35·0	0·74	1·15
Albany	71·3	91·6	55·6	43·0	0·23	1·36
Merredin State Farm	...	...	57·8	49·8	0·05	0·42
Northam	90·8	104·5	57·8	50·0	0·10	0·39
York	87·0	104·8	56·6	48·4	0·02	0·43
Narrogin State Farm	83·5	98·5	51·1	41·0	0·02	0·60
Katanning	80·1	100·7	51·5	38·0	0·02	0·66
Cape Leeuwin ...	70·9	86·0	58·4	53·0	0·55	1·28

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

No. 5.—*Fruit Drying.* By J. F. Moody. Free.
No. 15.—*Root Rot.* By A. J. Despeissis. Free.
No. 20.—*The Pruning of Fruit Trees.* By J. F. Moody. Price 2s. 6d.
No. 30.—*Codlin Moth.* L. J. Newman. (Reprint from "Journal.")
No. 46.—*Fruit Packing and Marketing and Exporting of Fruit.* By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—*The Poultry Keeper's Manual.* By G. Allman. Price 1s.
No. 83.—*Horticulture and Viticulture.* By A. Despeissis. Price 2s.
No. 49.—*The Feeding of Horses.* By Professor Paterson and G. L. Sutton. Free.
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No. 60.—*The Farmer's Clip.* By J. J. Mahood. Free.
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No. 79.—*Sheep on the Wheat Farm and their Management in W.A.* By H. McCallum. Free.
No. 87.—*Sheep Feeding Experiments: State Farm, Chapman,* 1920. By G. L. Sutton and F. Vanzetti. Free.
No. 88.—*Light Land: Conference.* By G. L. Sutton. Free.
No. 90.—*Stock Waters: Standard for Composition of.* By E. A. Mann. Free.
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No. 107.—*Sudan Grass.* By G. L. Sutton. Free.
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No. 111.—*Standard Wheat Varieties.* By G. L. Sutton and F. Vanzetti. Free.
No. 112.—*Automatic Device for Eradication of Stickfast Flea.* By G. Allman. Free.
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No. 114.—*Blue Mould on Citrus Fruits.* By W. M. Carne. Free.
No. 115.—*The Value of Windmills for Pumping Water in W.A.* A. H. Scott.
No. 116.—*Spotted Wilt of Tomatoes.* W. M. Carne.
No. 117.—*Cream.* P. G. Hampshire.
No. 118.—*Pigs and Pig Raising.* P. G. Hampshire.
No. 119.—*Take-all of Wheat and Similar Diseases of Cereals.* By W. M. Carne and J. G. C. Campbell.
No. 120.—*Pastures in the South-West.* A. B. Adams. (Reprint from "Journal.")
No. 121.—*Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals.* W. M. Carne and J. G. C. Campbell.
No. 122.—*Fruit Fly. Description and Control.* L. J. Newman.
No. 124.—*Government Inspection of Wheat.* G. K. Baron-Hay. (Reprint from "Journal.")
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No. 127.—*Wheat Yields—Competitions.*
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The Handbook of Horticulture and Viticulture of Western Australia, by A. Despeissis, M.R.A.C.:
This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible it has been reduced to 2s.

The Pruning of Fruit Trees, by J. F. Moody, Fruit Industries Commissioner:
This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price 2s. 6d.

Fruit Packing and the Marketing and Exporting of Fruit, by J. F. Moody, Fruit Industries Commissioner, and J. Ramage, Packing Instructor:
This publication contains invaluable information on packing and grading fruit for local and export markets. It is freely illustrated, and no fruit-packing shed should be without a copy. Price 1s. 6d.

The Poultry Keepers' Manual, by George Allman, Government Poultry Expert:
This is a most useful and valuable book, not only for beginners, but to all those who keep fowls for pleasure and profit. It deals fully with all matters connected with the industry, including Breeding, Feeding (for stock birds or egg production), Incubating, Brooding and care of chicks, Marketing (eggs and poultry), and all matters of use to the poultry-keeper. It also fully describes symptons of various ailments and diseases and simple treatment for same, and, as the book was written to suit *local conditions*, every poultry-keeper should have a copy by him. Price, 1s.

Agricultural Bank.

ADVANCES TO FARMERS.

The Agricultural Bank, which is a State institution and is worked under a Special Act, was founded with the object of making advances to settlers for the purpose of assisting and encouraging them during the early years of the development of their farm.

The Agricultural Bank makes advances on approved securities to approved persons engaged in the business of farming or grazing, or in horticultural pursuits, to an amount not exceeding £2,000.

Every application must be made on the prescribed form, and must contain full particulars of the purposes for which the advance is required.

Where an advance is approved for effecting improvements on the borrower's land, such advance is made by progress payments as the work progresses.

Developmental advances are usually made for clearing, fencing, ringbarking, and water supply, and are made to the full value of the work done after it has been inspected and certified to by a responsible officer. After a reasonable stage of development has been reached, and providing the general progress of the settler is considered satisfactory, limited assistance is granted towards building (maximum £250), and money is provided to assist in the purchase of stock and machinery, the maximum amount for this purpose, except in special cases, being £150.

Interest is charged at the rate of seven per cent. per annum, and repayment of principal extends over a period of 30 years, except in the case of stock or machinery advances which have a currency of eight years only.

The security required by the Bank is a first mortgage over the lands on which the advance is to be expended, and such lands may consist of:—

(a) Holdings in fee simple; or
(b) Holdings under Special Occupation Lease or Conditional Purchase from the Crown; or
(c) Homestead Farms; or
(d) Such other real or leasehold property as the Trustees may think fit.

Mortgages are prepared free of charge; but borrowers are required to pay the statutory costs of registration.

Interest only on the advances made is charged during the first 10 years, and repayment of the capital does not commence until the eleventh year.

Application may be for sums of £25, or any multiple thereof, not exceeding £2,000. Each application must be accompanied by a valuation fee of one per cent of the amount applied for. No refund of fee is allowed after an inspection of the security has been made.

The leases, or Occupation Certificate, as the case may be, together with the fees, must be in the possession of the Bank before a mortgage can be prepared.

REGISTRATION FEES.

	s.	d.
For each Conditional Purchase, Homestead Farm, or Grazing Lease under the Land Act ...	5	0
For each Freehold Lot or Crown Lease ...	10	0
For every additional Freehold Lot or Crown Lease ...	2	0

STAMP DUTY.

	s.	d.		s.	d.
Up to £50 ...	1	3	From £301 to £400 ...	10	0
From £51 to £100 ...	2	6	,, £400 ,, £500 ...	12	6
,, £101 ,, £150 ...	3	9	Stock Bill of Sale, up to £50	5	0
,, £151 ,, £200 ...	5	0	,, ,, over £50	10	0
,, £201 ,, £250 ...	6	3	Machinery Bill of Sale, up to £50	5	0
,, £251 ,, £300 ...	7	6	,, ,, ,, over £50	10	0

Intending borrowers are requested to note that no advances are made against improvements effected prior to date of application. Applications should, in every instance, be lodged prior to commencement of work, and moneys are then paid over in progress payments as the work proceeds.

IMPROVED FARMS.

The Trustees of the Agricultural Bank have, from time to time, improved farms on their hands which have been abandoned for various causes, or have been taken over as security for loans. These farms are available for purchase, and extended terms are given for payment of the amount. They often offer to intending settlers an opportunity of obtaining an improved holding, ready for occupation, at a cheap rate, without having to undertake the preliminary work of clearing and fencing. The properties, when obtainable, are advertised in the "Government Gazette"; but anyone wishing for particulars of such farms as may be available should make application to the Managing Trustee of the Agricultural Bank. Particulars will then be sent, and an inspection can be made by the intending settler to ascertain whether the same is suitable for his requirements.

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